DEPARTMENT OF THE INTERIOR AND RELATED AGENCIES APPROPRIATIONS FOR 1991

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

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DEPARTMENT OF THE INTERIOR AND RELATED AGENCIES APPROPRIATIONS FOR 1991

Tuesday, March 20, 1990.

DEPARTMENT OF ENERGY EMERGENCY PREPAREDNESS

WITNESSES

HOWARD G. BORGSTROM, DIRECTOR, OFFICE OF PLANNING AND FINANCIAL MANAGEMENT FOR PETROLEUM RESERVES, FOSSIL ENERGY

GUY CARUSO, DIRECTOR, OFFICE OF ENERGY EMERGENCY POLICY AND EVALUATION

JOHN J. EASTON, ASSISTANT SECRETARY, INTERNATIONAL AFFAIRS AND ENERGY EMERGENCIES

MICHAEL R. McELWRATH, PRINCIPAL DEPUTY ASSISTANT SECRETARY, FOSSIL ENERGY

MARK RODEKOHR, DIRECTOR, INTERNATIONAL AND CONTINGENCY INFORMATION DIVISION, ENERGY INFORMATION ADMINISTRATION

ROBERT A. SPEIR, OFFICE OF OIL POLICY, OFFICE OF POLICY, PLANNING AND ANALYSIS

Opening Remarks

Mr. Dicks [acting chairman]. The committee will come to order.

The principal witness today is John J. Easton, Assistant Secretary for International Affairs and Energy Emergencies. We want to welcome you and your supporting witnesses who I will let you identify for the record. I thought we would allow you to go ahead and start. We'll put your entire statement and biographies in the record, and then go ahead and make your presentation, and after that we'll have some questions.

[The biographies and statement of Mr. Easton follow:]

U.S. Department of Energy
Office of the Secretary
Washington, D.C 20585
202/586-5534

BIOGRAPHY

JOHN J. EASTON, JR.

John J. Easton, Jr. was nominated by the President on June 22, 1989 to be Assistant Secretary for International Affairs and Energy Emergencies, U.S. Department of Energy (DOE), and confirmed by the Senate on October 5, 1989. In this position, he serves as the principal international policy advisor to the Secretary and spokesman for the Secretary on matters of international importance. He also coordinates DOE's non-nuclear emergency preparedness planning and emergency operations.

In addition, Mr. Easton is responsible for maintaining DOE's relationship with foreign governments and international energy organizations, the development of departmental positions for international negotiations, and the implementation of international cooperative agreements.

Prior to joining the Department of Energy, from 1987 to 1989, Mr. Easton was in private law practice with the Burlington, Vermont law firm of Miller, Eggleston and Rosenberg, Ltd. Before that, he was Vice President of Syn-Cronamics, Inc., a New Jersey based international consulting firm.

Mr. Easton was twice elected Attorney General of Vermont and served in that position from 1981 to 1985. In 1984, he was the Republican candidate for Governor.

Prior to his selection as Attorney General, Mr. Easton served for two years as Director of the Division of Rate Setting for the Agency of Human Services. From 1975 to 1978, Mr. Easton was Assistant Attorney General and Chief of Consumer Protection. For five years previous to this position, he was in private law practice in Stowe and Montpelier, Vermont.

Mr. Easton was educated in elementary schools in Virginia, Georgia and French Morocco, and high schools in Nebraska and California. He attended the University of Colorado (B.S., Accounting, 1964), and Georgetown University Law Center (J.D., 1970). Mr. Easton served in the U.S. Air Force from 1964-68, resigning with the rank of Captain.

Mr. Easton has held a variety of leadership positions in the American Bar Association and the Vermont Bar Association. He also served on the boards of several Vermont organizations prior to joining DOE.

Mr. Easton is currently living in Arlington, Virginia.

October 1989

U.S. Department of Energy
Office of Scheduling
Washington, D.C. 20585
202/586-4292

BIOGRAPHY

ARLEN I. ERDAHL

Arlen I. Erdahl was sworn in as the Principal Deputy Assistant Secretary for International Affairs and Energy Emergencies, U.S. Department of Energy, on October 16, 1989. In this position, Mr. Erdahl directs the day-to-day activities of the office, which is responsible for developing and directing the country's international energy policy and coordinating its emergency preparedness planning.

Mr. Erdahl comes to the Department from the Peace Corps where he served from 1983 to 1989, most recently as Special Advisor to the Director. While at the Peace Corps, Mr. Erdahl also held the positions of Associate Director and Country Director in Jamaica.

From 1979 to 1983, Mr. Erdahl was a member of Congress, serving Minnesota's First Congressional District. During his years in the House, he was a member of the committees on Education and Labor, Foreign Affairs and Small Business. Mr. Erdahl also served on the Foreign Affairs subcommittee on International Economic Policy and Trade. While in the House, he also held the position of U.S. Delegate to the Inter-parliamentary Union Annual Meeting in Oslo and was Advisor to the U.S. Delegation to the United Nations Conference on refugees in Geneva.

A native of Blue Earth, Minnesota, Mr. Erdahl has also been a soldier, a farmer and a registered representative for an investment company. He also served Minnesota as its Secretary of State, as a member of its Public Service Commission and as a member of its House of Representatives.

His educational experience ranges from a one room country school, to St. Olaf College, where Mr. Erdahl received a B.A. in 1953, to Harvard University, where in 1966, he received a Masters Degree in Public Administration. Under a grant from the Bush Foundation, Mr. Erdahl also served as a Congressional Fellow and Staff member to House Minority Leader Gerald Ford and to Senator Mark Hatfield.

Awards received by Mr. Erdahl include the Leadership for Peace Award; Minnesota Youth Government Award; Hubert H. Humphry Award for Congressional Leadership in Rehabilitation programs; Distinguished Alumnus of St. Olaf College; and selection as one of the Ten Outstanding Young Men of Minnesota by the Jaycees.

Mr. Erdahl is married to the former Ellen Syrdal. They have two daughters, Laura and Kari, and four sons, Rolf, Eric, John and Lars. The Erdahls currently reside in Annandale, Virginia.

October 1989

U.S. Department of Energy
Office of the Secretary
Washington, D.C. 20585
202/586-5534

BIOGRAPHY

Guy F. Caruso

Current Position

Director, Office of Energy Emergency Policy and Evaluation
U.S. Department of Energy
Forrestal Building
Room GE-262
Washington, D.C. 20585

Professional Experience

Mr. Caruso has also been Head of the Oil Industry Division, International Energy Agency, Paris, France, during September 1982-September 1985, joining the Agency from U.S. Department of Energy. In this position Mr. Caruso was responsible for analyzing world oil supply and demand and developments in the oil industry.

Mr. Caruso joined the US/DOE in August 1978 as a Senior Energy Economist in the Office of International Affairs and was appointed Director, Office of Market Analysis in July 1980. During 1966 to 1978 Mr. Caruso served with the Central Intelligence Agency as an International Energy Economist in the Office of Economic Research.

Education

Mr. Caruso received a B.S. degree in business administration in 1964 and an M.S. degree in economics in 1966. Both degrees were awarded by the University of Connecticut. He received an M.P.A. degree in public administration from Harvard University in 1975.

Department of Energy
Washington, DC 20585

BIOGRAPHY

Robert A. Speir
Office of Oil Policy
Office of Policy Planning and Analysis
Department of Energy

Mr. Speir was raised in Orlando, Florida and received his B.A. in mathematics, with a minor in physics, from Florida State University in 1964. In 1972, he received a M.S. in Industrial Systems Engineering (Operations Research) form Georgia Institute of Technology.

During 1965-73, Mr. Speir worked as an operations analyst for the U.S. Air Force Armament Laboratory first as an Air Force officer, and later as a civilian. There, he developed and employed computer models of Soviet air defenses, evaluated effectiveness of air delivered weaponry, and designed and employed weapons inventory selection programs.

In 1973, Mr. Speir transferred to Washington to the Office of the Secretary of Defense in the Office of the Assistant Secretary for Program Analysis and Evaluation. In the role of a tactical air program analyst he wrote position papers for the Secretary recommending funding and hardware development decisions. Other areas of involvement included conventional weapons (air and ground delivered), Army and Soviet air defense, and the NATO/Warsaw Pact force balance.

Mr. Speir joined the Energy Information Administration (EIA) in 1979. There he performed in various managerial and technical roles related to EIA's collection of statistics on, and and analysis of the petroleum industry. His accomplishments include: directing in-house development and use of a refinery model to evaluate the effects of reducing gasoline volatility; calculating indices used to price Naval Petroleum Reserve oil sales; evaluating prices paid for Strategic Petroleum Reserve crude oil during compared to those paid by other oil importers; providing data and analysis that was the basis for five articles during 1988 and 1989 in the widely-read journal Petroleum Intelligence Weekly; writing numerous technical papers and responses to congressional and public inquiries about petroleum product and crude oil markets.

In the spring of 1989, Mr. Speir was temporarily assigned to the Office of the Secretary of Energy to work as a special assistant on matters related to fossil fuels. From there he moved to the Office of Oil Policy. Between August 1989, and February 1990, he was the Office of Policy, Planning and Analysis representative on the interagency SPR size study, and contributed substantially to the study's technical management.

Department of Energy
Washington, DC 20585

Michael R. McElwrath
Principal Deputy Assistant Secretary
for Fossil Energy
U.S. Department of Energy

Mike McElwrath serves as Principal Deputy Assistant Secretary for Fossil Energy at the U.S. Department of Energy. His responsibilities include management of coal, oil, and unconventional gas research and development programs as well as the Naval Petroleum and Oil Shale Reserves and the Strategic Petroleum Reserve and overseeing the national Clean Coal Technology Program.

Prior to his appointment with the Department of Energy, Mr. McElwrath served a dual role for former Secretary Don Hodel at the Department of the Interior. He was Deputy Assistant Secretary for Policy overseeing all policy initiatives for the Department and was also special Energy Advisor to the Secretary. Given the Department of Interior's federal jurisdiction over mining, minerals, and coal, Mr. McElwrath added substantially to his extensive expertise in oil, gas, and energy.

Before joining the Reagan Administration in January 1988, Mr. McElwrath spent ten years as an oil and gas attorney in Midland, TX, during one of the most volatile periods in the nation's energy industry. He worked with all aspects of the energy industry including major corporations, wildcatters, service organizations, and consumer groups.

A native of Houston, TX, Mr. McElwrath received both his undergraduate and law degrees from the University of Texas at Austin. He is married to the former Patricia Northern. They have two sons, Mac and Sean, and reside in Arlington, Virginia.

March 1990

Department of Energy
Washington, DC 20585

HOWARD G. BORGSTROM

Howard G. Borgstrom is currently serving (since July 1989) as Director, Office of Planning and Financial Management, Petroleum Reserves, Fossil Energy, U.S. Department of Energy (DOE), a position he had previously held from October 1985 through May 1988. In this capacity, he is responsible for budget and policy development for the Strategic Petroleum Reserve and the Naval Petroleum and Oil Shale Reserves. In late 1989 and early 1990, he chaired the Interagency Working Group which prepared the February 1990 study on alternative methods for financing the Strategic Petroleum Reserve.

From May 1988 through July 1989, he served as Director, Office of Business Operations, Fossil Energy, during which he was responsible for divestiture of the Great Plains Coal Gasification Project, Fossil Energy international and intergovernmental affairs, security, and other functions.

Prior to 1985, Mr. Borgstrom had served in a series of management positions in the Strategic Petroleum Reserve Office from 1979 to 1985. Mr. Borgstrom joined the Department of Energy in 1979 after serving at the Office of Management and Budget (OMB) since 1972. While at OMB, he was the Budget Examiner for the Strategic Petroleum Reserve (1978-79) and for Federal Indian Programs (1974-77) and conducted special studies on energy programs, program evaluation, and other management topics.

Before joining the Federal Government, Mr. Borgstrom had served from 1970 to 1972 as Chief of the Administrative Response Staff in the office of the County Executive of Fairfax County, Virginia.

Mr. Borgstrom was born in Morristown, New Jersey in 1948 and graduated from Phillips Academy, Andover, Massachusetts, in 1966. He received a B.A. degree from Wesleyan University in 1970, a Master of Public Administration from the George Washington University in 1977, and is currently a doctoral candidate at George Washington School of Government and Business Administration. He is married to Carol Borgstrom, and they live in Virginia with their two children.

March 1990

Statement of John J. Easton, Jr.
Assistant Secretary for International Affairs and
Energy Emergencies
Department of Energy
Before the House Committee on Appropriations
Subcommittee on Interior and Related Agencies
March 20, 1990

Mr. Chairman and members of the Subcommittee, it is my pleasure to appear before you today in support of the President's FY 1991 budget proposal of $6,467,000 for the Office of Energy Emergencies.

The budget for the Office of Energy Emergencies supports the national energy policy goal of fostering an adequate and secure supply of energy to the country at a reasonable cost. This means sufficient energy supplies to meet our short and long-term needs without undue dependence on insecure sources or on any single source of supply.

To help achieve this goal, the Energy Emergencies Preparedness Program seeks to promote energy security and thereby reduce the Nation's vulnerability to energy supply disruptions.

The Program supports policies, programs and procedures to:

- ensure that the Nation has sufficient energy supplies to meet defense and other vital national needs during peacetime and mobilization periods;
- respond to a full spectrum of energy emergencies encompassing oil, electricity, natural gas and coal, as we did during Hurricane Hugo, the Loma Prieta earthquake and the heating oil/propane shortage situation last December;
- draw down and distribute the Strategic Petroleum Reserve (SPR);
- fulfill commitments to the International Energy Agency (IEA), the North Atlantic Treaty Organization (NATO) and other international commitments;
- assure Congress, States, localities and the public of timely, accurate information, analyses and assessments about energy emergencies, both foreign and domestic, as they develop;
- coordinate Federal energy actions through the Federal Emergency Management Agency (FEMA) with States, localities and industry during a domestic energy emergency;
- ensure that Federal energy emergency responses are based on the best possible assessment of the energy situation;

- ensure response readiness through emergency planning activities, training and participation in civilian and military exercises; and

- ensure the performance of the Department's essential functions in the event of war.

The Emergency Preparedness Program provides the Department with a cadre of trained professionals with institutional knowledge and experience in energy resources (e.g., petroleum, natural gas, electricity and coal), industry operations, market analysis, national security affairs, and crisis management. They are supported by integrated energy information systems and analytical tools, and in an energy emergency, this cadre can be augmented by other Departmental staff, interagency efforts, and experts drawn from industry.

FY 1990 ENERGY EMERGENCIES PROGRAM

During FY 1990, the Office of Energy Emergencies continues to assess energy vulnerabilities and to develop policies and programs to address those of significant risk to the Nation's security. We will continue to examine policies and measures to reduce vulnerabilities, attempt to preempt emergency occurrences, mitigate impacts if they do occur, and restore normal operations. To support these goals, the office will:

- refine the Department's energy emergency preparedness management function to ensure continued readiness, including the conduct of exercises to enhance participants' capabilities;

- examine the vulnerability of the U.S. energy production and distribution infrastructure to disruptions;

- participate in the second test of IEA Coordinated Emergency Response Measures (CERM); train industry personnel for participation in the NATO Wartime Oil Organization; participate in the development of IEA policies to reduce vulnerability to oil disruptions; participate in IEA emergency response program reviews to promote an internationally coordinated response in an emergency; provide technical support to NATOs Petroleum Planning Committee; coordinate interagency studies dealing with military plans to convert to kerosene based jet fuel in Europe and evaluate its impact on civilian and military jet fuel supplies; increase efforts to encourage IEA allies to expand their strategic stocks in line with U.S. commitments to fill the SPR to 750 million barrels.

- enhance liaison activities with industry and state energy offices including maintaining communications and information links and participating in tests and regional seminars to ensure coordination in responding to energy emergencies;

- participate with other government agencies in domestic and international tests and exercises to improve Continuity of Government (COG) and mobilization and energy emergency response capabilities including vulnerability studies of critical end-users;

- continue to support emergency assignments directed by the Executive Office of the President concerning emergency preparedness, response and recovery from catastrophic disasters, natural or man-made, that impact critical facilities of the Department of Defense, and that impact interstate energy systems;

- refine the Energy Emergency Management System (EEMS) to respond to policy and program changes; and conduct preparedness activities including training and exercises to ensure readiness; two additional initiatives are implementing a critical event reporting procedure as part of the EEMS process, and the expansion of the Department's natural gas emergency response capabilities;

- conduct detailed analyses of major Strategic Petroleum Reserve (SPR) issues such as prequalification of bidders, restricted bidder universe, Jones Act waiver requirements, and in cooperation with Fossil Energy study SPR financing and sizing options;

- recruit industry executives for the National Defense Executive Reserves (NDERs) to bring strength to about 275 and implement the petroleum NDER program; integrate NDERs into Federal COG program; develop DOE procedures on the use of NDERs in DOE programs for management of energy resources for essential needs in national security emergencies; begin to develop standby DOE orders for a pre-delegation of DPA authorities to NDER regional managers during communication cut-off conditions; develop an advanced NDER training course;

- continue to monitor domestic and international energy events to ensure early warning of emergency situations including updating the Alert Coordination Officer (ACO) system procedures, expanding communications links and other information sources, and enhancing emergency assessment procedures;

- continue to fulfill the Department's responsibilities to the COG program including increasing the number of participants on national and regional teams, establishing training programs for all team members and standardizing deployment and employment procedures;

- initiate joint planning with State energy offices and public utility commissions to ensure that local plans for emergency energy distribution reflect the energy needs of end-users whose continued operations is essential for national security;

- work with the Canadian Government to assure compatibility between Canada's classified Vital Points Programme, and the U.S. Key Assets Protection Program with respect to physical security of critical energy facilities;

- o continue to expand analytical processes and systems support capabilities for inclusion of states in DOE vulnerability assessment and mitigation efforts as well as energy situation monitoring and assessment systems; develop closer working relationship between states and NDERs;
- o support the Industry Vulnerability Evaluation Software Technology (INVEST) program which will evaluate the security and vulnerability of the U.S. energy infrastructure;
- o expand the capabilities of the energy emergencies program to monitor and assess energy situations and to evaluate impacts on energy supplies through the development of microcomputer based applications including a geographic information display system, and enhancements to the energy emergency locator system; and
- o develop and implement procedures to process priority requests from industry for restoration of telecommunications services.

FY 1991 EMERGENCY PREPAREDNESS BUDGET REQUEST

The FY 1991 budget request for the Office of Energy Emergencies is $ 6,467,000, a 1% decrease from the FY 1990 appropriation. A summary follows:

	FY1990 Appropriation	FY1991 Request
Program Direction	$ 5,493	$ 5,493
Emergency Planning	483	399
Emergency Operations	575	575
Total	$ 6,551	$ 6,467

During FY 1991, we will continue to emphasize energy emergency preparedness activities both internationally and domestically. A variety of energy emergency preparedness tests, exercises and simulations will allow us to assess our approach to emergency planning, operations and policy analysis, while identifying and assessing those areas that require new programs or procedures or priority attention by the Executive and Legislative branches of Government. We will continue to develop in-house expertise for planning, operations and policy analysis and evaluation activities as the most effective strategy for accomplishing energy emergency objectives. Furthermore, we will:

- o in coordination with the Energy Information Administration (EIA), enhance the Department's capability to detect and assess conditions such as that which occurred during the severe cold weather of December 1989 and January 1990; disseminate resulting information to all relevant parties; and evaluate Federal response policies to future emergencies;

- maintain the Department's readiness for emergencies by continuing preparedness exercises, implement changes to operating procedures and provide information to senior level DOE staff on emergency energy supply situations; continue the OEE monitoring program to ensure early warning of emergency situations including refining emergency criteria, communications links and incident evaluation and reporting procedures;

- review OEE preparedness activities to ensure compatibility with the Department's National Energy Strategy;

- expand activities with Canadian energy industries, including development of the Formalized Automated Vulnerability Assessment software;

- expand efforts in support of coordinated stockdraw as the preferred international response in the event of an oil supply disruption, and of more equitable burdensharing among our IEA partners of the cost of creating and increasing government-owned and -controlled strategic stocks. The U.S. will continue its efforts to have our IEA partners justify their use of demand restraint programs as an emergency response.

- continue to participate in IEA and NATO emergency programs, including plan for participation in the seventh test of the IEA Emergency Oil Sharing System (AST-7);

- continue to support Presidential and Congressional tasks as well as DOD preparedness requirements related to Graduated Mobilization Response;

- expand EEMS operating procedures to address a wider range of potential emergency scenarios and fuel types; develop and expand active team membership including development of a standby organization of Federal and Executive Reserve resources in each area; conduct training, simulations and exercises; enhance and refine the analytical and decisionmaking process to ensure the selection of the best mix of response options;

- continue to cooperate with other government agencies, energy suppliers and users in vulnerability studies, including initiatives with North American Reliability Council (NERC) to determine critical end-user requirements and backup capabilities;

- continue to develop the state liaison program through enhancing communications/information links, regional seminars and simulations, vulnerability assessment and mitigation efforts, energy situation monitoring and assessment activities; and develop closer working relationship between states and NDERs;

- expand and integrate DOE HQs and field COG structure with participants from DOE operations offices, DOE national labs, state, local and private industry organizations; refine standby policies, programs and procedures to respond to COG national security emergencies.

- initiate an office-wide Local Area Network for improved communications and data sharing; continue to refine and expand the capabilities of the Automated Office and Information System by using microcomputer resources to monitor and assess day-to-day events which might develop into an energy related crisis, and for analytical support during tests and exercises;

EMERGENCY PLANNING

The FY 1991 budget request for Emergency Planning is $399,000, a 17% decrease from the FY 1990 appropriation. The request provides contract assistance to support the preparation, conduct and evaluation of emergency preparedness tests, exercises and simulations (e.g. the second Coordinated Emergency Response Measures test (CERM), REX-ALPHA, NATO Wartime Oil Organization training). Through this activity, emergency management processes will be developed and refined to augment in-house staff and provide assistance in conducting follow-up activities. Additionally, contract assistance will be used to support analysis of domestic energy security issues (e.g. vulnerability of U.S. energy systems, facilities and networks), support for IEA and NATO energy security analysis, and support for national security analyses for FEMA Special Compartmented Programs (these tasks are required by Presidential Directives and require major analytical efforts that involve modeling and simulation of defense energy requirements in the event of mobilization and other defense-related activities).

EMERGENCY OPERATIONS

The FY 1991 request for Emergency Operations is $575,000, the same level as the FY 1990 appropriation. The request provides for contract support to COG test procedures and essential functions; support data services for modeling and impact analyses of classified scenarios or emerging threat conditions; special programming assistance; maintain electronic mail service to support exchange of information with State and local governments, and DOE operations offices; and acquisition of commercial timesharing services, software and hardware upgrades, and information system.

PROGRAM DIRECTION

The FY 1991 request for Program Direction is $5,493,000, the same level as the FY 1990 appropriation. The request provides for salaries for 71 FTEs, travel, training, and administrative overhead and telecommunications costs.

This concludes my formal statement on our FY 1991 budget request. I will be pleased to answer any questions you may have.

Mr. **Easton**. Thank you, Mr. Chairman.

Let me first introduce my colleagues here. We understood that the Committee wanted to have a wide sampling of Departmental officials so that we could answer any questions that might come up related to my budget or other issues.

On my immediate right is the Principal Deputy Assistant Secretary for Fossil Energy, Michael McElwrath. Howard Borgstrom is next to him. Howard is the Director of the Office of Planning and Financial Management for Petroleum Reserves. Then on my left is Guy Caruso, who is the Director of my Office of Energy Emergency Policy and Evaluation. Mark Rodekohr from the Energy Information Administration is next to him. Mark is the Director of International and Contingency Information. And then finally on the far end is Robert Speir. Bob is from the Office of Oil Policy in our Office of Policy, Planning and Analysis.

I think among those of us we should be able to take your questions.

Mr. **Dicks**. Good.

OPENING STATEMENT

Mr. **Easton**. I'm glad to be here to discuss our budget for the Office of Energy Emergencies. It is our mission in the office, Mr. Chairman, to support the national policy goal of the adequate and secure supply of energy and to strengthen our Nation's ability to effectively respond to non-nuclear energy emergencies. Towards this goal, I am pleased to have the opportunity to list some of our recent accomplishments.

The past year we had several opportunities to test parts of our emergency response program through our activities in connection with Hurricane Hugo, the Loma Prieta earthquake, numerous oil spills in the New York Harbor vicinity, and then last December's heating fuel situation. We have already seen several key functions of our program enhanced, and we have learned several lessons through these experiences.

For example, our State liaison function proved highly effective in the exchange of information with our Nation's State energy offices. During both the hurricane and the earthquake, we were able to receive timely and accurate information through this liaison program, so that we could assess the damage and then coordinate the relief activities with the Federal Emergency Management Agency—FEMA. The information we obtained through our State contacts was invaluable to our decisionmaking and to our ability to provide useful information to Members of Congress, other States, and private citizens as well.

Our Office of Energy Emergencies has continued simulation exercises designed to examine energy emergency preparedness issues. We recognize that any energy emergency will require extensive coordination. These exercises involve several other Federal agencies, State officials, international representatives, and industry experts.

Several of the areas that we are looking into as a result of this planning process are: the need for an expanded Department of Energy role in the coordination with FEMA, the need for improved procedures to ensure priority access for national security requirements, and the need for more expeditious relaxation of regulatory requirements such as Jones Act provisions during energy emergencies.

Some of our other recent activities include a major international conference sponsored by the International Energy Agency, which emphasized the importance of petroleum stocks and stockholding. In addition, we supported NATO conferences of oil industry experts, who were recruited and trained by the Department as part of its ongoing NATO readiness program. In the balance of Fiscal Year 1990 and during Fiscal Year 1991 we will maintain the momentum that we have achieved through a number of initiatives, addressing new issues which should surface during this present fiscal year.

Also, during the recent past we have completed an important interagency analysis of size options for the Strategic Petroleum Reserve, and I'm sure you'll want to discuss some of that today.

One important program that we continue to improve is our Continuity of Government—our COG program. This is the Government-wide program aimed at assuring that the essential Government functions will be performed during a national crisis. We also continue to study domestic and international issues, such as the Panama Canal and pipeline and their importance to the U.S. energy supply; improvement to our current emergency monitoring and response procedures; the reliability, costs, and benefits of regional petroleum reserves; and the exploration of alternate means of dealing with the hardships of extreme energy market aberrations.

With respect to our continuing participation in the International Energy Program—the IEP—we are already working on plans for our participation in the second test of the procedures of the IEA Coordinated Emergency Response Measures—the CERM Test II—which will be held at the end of this year. These procedures have succeeded in institutionalizing a more market-oriented international response mechanism. We're actively participating in the IEA's emergency response program reviews to ensure that IEA members are fully prepared to contribute if an emergency should strike.

Finally, among the significant international efforts planned by NATO's Petroleum Planning Committee, will be a new report to NATO on petroleum supplies and vulnerabilities in the 1990s.

Some of the additional activities we plan in Fiscal Year 1991 include: continuing to improve and enhance the vital National Defense Executive Reserve—the NDER program—and to work with the relevant Congressional committees in making the improvements needed to the Defense Production Act and stimulate even greater participation in the NDER program. We are studying, and we'll continue to study in Fiscal Year 1991, major ongoing issues, such as alternative procedures and policies to distribute and draw down the SPR. We'll be looking at issues, for example, such as prequalification of bidders, restrictive bidder universe, and improved flexibility in the sale of incoming SPR shipments.

In conclusion, Mr. Chairman, the energy emergency preparedness program is intended to foster realistic planning and preparation for a wide spectrum of emergencies involving all major energy sources. It necessitates a close interaction with our allies and international trading partners, other Federal agencies, the Congress, States, and the private sector. It involves the development of reliable information systems, communications capabilities, emergency procedures, and organizational structures.

Our budget proposal for the Office of Energy Emergencies for Fiscal Year 1991 is admittedly modest, but we believe it is sufficient to accomplish the purposes that I have outlined.

ELECTRICITY SHORTAGES

Mr. Chairman, I'll be pleased to take your questions.

Mr. DICKS. I'm going to focus on the Strategic Petroleum Reserve first, but before I start on that let me ask you this general question. We have been working on SPR for a number of years, and I can understand being able to deal with fossil fuels. What would happen if we had a major catastrophe with the production of electricity? How do you plan for that? How do you deal with that situation?

Mr. EASTON. Excellent question. We certainly don't anticipate a major catastrophe, but we are very concerned with increasingly tight margins, particularly in certain parts of the country. For example, the Northeast margins are very low at the moment. During this recent cold snap in December, there were rolling blackouts in both Texas and Florida.

Our office spends a lot of time working with the North American Electric Reliability Council in order to try to assess the vulnerabilities in the electric system, and then take actions to mitigate those vulnerabilities. I think we are probably more successful in the electricity sector in bringing in National Defense Executive Reserves—the NDERs. We have appointed 52 NDERs already. We have applications, I think, for another 16 currently pending. These utility executives will be invaluable to us in dealing with any sort of——

NATIONAL DEFENSE EXECUTIVE RESERVES

Mr. DICKS. What do the NDERs do?

Mr. EASTON. They are available to us—in fact, some of them are participating at the moment in an exercise we're conducting in New Hampshire with the Northeast State officials to test our emergency response plans and procedures. Their authorization is under the Defense Production Act, and they are available to us both in non-emergency situations, such as our exercises, to assist us in realistic planning and in taking corrective action, and during a national emergency where the Defense Production Act would be invoked. These NDERs, both in the electric sector and elsewhere, would actually come in and help us manage the emergency.

We do have the power administrations in DOE, but outside of that we really don't run the Nation's energy systems. We don't run the refineries or the coal mines, so as a result these NDERs, in the event of an emergency, would bring us valuable experience to help us conduct the operations through such an emergency period of time. We'll be having in this week, for example——

Mr. DICKS. Are these people from the private sector?

Mr. EASTON. Yes, sir, they are.

Mr. Dicks. So they are the people that are directly involved in managing these various facilities and utilities?

Mr. Easton. These are senior operational executives from the different energy sectors. For example, later this week, a couple of days from now, the Natural Gas Executive Reserve will be in Washington, DC for a session. Some of the things they will be doing is they'll be giving us a progress report on their activities over the last year. They'll be addressing pipeline security issues, and then they'll be reviewing the actions taken at the California earthquake.

OTHER VULNERABILITY ASSESSMENTS

Mr. Dicks. Testimony last year also indicated some progress beyond the electric industry in getting cooperation from the industrial sector on assessing the vulnerability of facilities. What specific activities have taken place in these other sectors? You have touched upon some of it.

Mr. Easton. I mentioned, just a moment ago, what we were doing in the gas sector. This week, the natural gas reservists will be in town reporting on both pipeline security as well as what was learned from the gas disruption as part of the California earthquake where there were extensive breakages due to the earthquake.

In addition, we have been successful in adding to the numbers of NDERs in both the natural gas area as well as the solid fuels area. The one place where we still need to do work is in the oil sector. We are hoping that some current amendments to the Defense Production Act will alleviate some of the perceived problems that oil executives have in participating in the NDER program

Mr. Dicks. What are those?

Mr. Easton. The oil executives are concerned that collective participation might open them up to allegations of violating the antitrust laws, so there are provisions in the proposed Defense Production Act amendments that would alleviate that problem.

Mr. Dicks. Is that a problem for other sectors, too? Coal?

Mr. Easton. Conceivably it could be, but those executives don't seem to feel——

Mr. Dicks. They may not have the expensive lawyers to advise them.

Mr. Easton. Or they haven't felt the wrath of some suits perhaps.

VULNERABILITY ASSESSMENT OF FACILITIES

Mr. Dicks. Are you making significant progress in being able to assess the vulnerability of facilities?

Mr. Easton. Yes. Let me tell you one of the steps we are taking right now. We have a program—the Government use of acronyms again; INVEST is what it is called—to help us measure threats against energy facilities, whether it's a utility, generating plant, or one of our own facilities. The Office of Fossil Energy is helping us sponsor that effort to analyze the security of our Strategic Petroleum Reserve facilities. The INVEST program will markedly help us measure the threats and then take the appropriate action to deal with threats to facilities.

Mr. DICKS. Are we investing any money, or do we go to the private sector and ask them, "We think your facility is vulnerable." Do you fix it?

Mr. EASTON. What we're doing right now is we are working with one of our National Labs, Lawrence Livermore. Mike's office has contributed some contract money. My office has contributed some contract money. Originally, it started with defense programs putting up some money so that we could have the Lawrence Livermore design a vulnerability system that would measure the vulnerabilities of facilities. We're testing some of these concepts with Texas Utilities. They are participating with us and making their facilities available.

Through this effort we will be able to offer advice and a package to the private sector saying, "Here's what we have learned. Here is what we have developed. Here is what you can then apply to your own facilities."

Mr. DICKS. Are they interested in this, or do they see this as just another expense the Government may require them to——

Mr. EASTON. Based on the enthusiasm of Texas Utilities, who operate a wide variety of generation plants, we think the private sector is going to be fairly interested. TU is very cooperative in saying that they wanted to participate with us. They wanted us to come in and look at their plants and apply the system that is being developed to their plants. I think if that attitude is typical, we'll see a receptive attitude throughout the industry.

STRATEGIC PETROLEUM RESERVE SIZE STUDY

Mr. DICKS. Okay. An interagency group recently submitted, through the Department of Energy, a study on the desirable size of the Strategic Petroleum Reserve. Please explain the main reasons that the study recommends not increasing the size of the reserve about 750 million barrels.

Mr. EASTON. The study was an interagency effort led by DOE but with a total of 12 other agencies which participated. Looking at international issues, national security issues, economic issues, and trying to evaluate what the appropriate size for our program would be, the conclusion reached was a SPR size of 750 million barrels. That conclusion was arrived at after weighing these various considerations that I have just mentioned, including national security, our international cooperative requirements, evaluating the international oil market structure, and the cost benefits of 750 million versus 1 billion barrels. After careful review, I think it was a unanimous decision of the Economic Policy Council to support the administration's recommendation to continue with 750 million barrels.

Mr. DICKS. Was this driven by OMB more than anybody else?

Mr. EASTON. No. I don't think so because what we were looking at here was not only economic issues but the increase in security that would result and also the structure of the international oil market which has to be reviewed as well as the likelihood of a disruption. We were looking at some of the CIA's estimates about what the likelihood of a disruption would be, how long it would last, and what the severity would be. So it wasn't just OMB, it was a number of agencies that were offering their expertise on what the likelihood would be and then what the benefits would be of an increased size.

Mr. DICKS. Previous studies have supported having a larger reserve. What factors or assumptions are different in the current study that lead to the current conclusion not to increase the size of the reserve? You touched upon some, but are there any others you'd like to mention?

Mr. EASTON. Well, I think the important ones are first, that the CIA used an assessment that was based on both some of its current intelligence and its review of the international situation, whereas some of the past studies—I think the most recent past study was based on probability models derived from years before. Secondly, the CIA estimate, which was concurred with by other security participants, looked at the likelihood of a disruption, the length of a disruption, and the severity of a disruption differently than some of those previous probability models that had been contained in earlier studies. As a result, those factors, among others, led to the conclusion that 750 million would be the appropriate size.

Mr. DICKS. I could understand saying that the threat is different in terms of the United States and the Soviet Union and Eastern Europe. The major problem in the past was the OPEC limitations. Now are they suggesting in this—is the CIA, as an underpinning for its conclusion, suggesting that the likelihood of that kind of a disruption is less today than it was in the past?

Mr. EASTON. I'll let one of my colleagues answer because I didn't participate in some of those discussions with the CIA. Let me open by saying that one of the differences today is that Saudi Arabia and Venezuela, two OPEC members, have substantial downstream investments in the United States. It is a very different condition than existed in 1973-1974. As a result of those downstream investments, it is really a change in the international oil market where it is not in the self-interest of these countries to perhaps disrupt the supply. That sort of behavior would foster a consumer response on our side that would cause us to conserve more, to shift alternate fuels, thus reducing their own earnings. That is a major difference that exists today compared to the 1973-1974 period.

The second major difference that exists from the 1973-1974 timeframe is the SPR itself—580 million barrels. That did not exist. The international——

Mr. DICKS. How long could we exist on that?

Mr. EASTON. Our stocks consist not only of the SPR, about 580 million barrels, but in addition we have the privately owned stocks, most of which qualify under the IEA's international energy program. Based on IEA calculations, we have stocks at the moment that are equivalent to 207 or 209 days of net imports. We're in pretty good shape in that respect. One of the considerations also is if we increase our stock holding to a billion barrels, it may cause some of our allies, whom we have been pushing very hard to build stocks, to consider that they don't have to build as much.

Mr. DICKS. How much do we import per day?

Mr. EASTON. We are approaching 50 percent. Our production, I think, is about 7½ million barrels a day at the moment. In January, we were at about the 50 percent mark, or a little above 50 percent, I think we were at 41 percent dependence for net imports for 1989. Depending on month by month, we sometimes go up over 50 percent, but we are importing about 7½ million barrels.

Mr. DICKS. And we can take about 3½ million barrels a day out of the SPR?

Mr. EASTON. That is correct.

Mr. DICKS. That is the capability?

Mr. EASTON. Yes, sir.

Mr. DICKS. How much would you be able to get from the private sector? You talked about their reserves. Do we know what that would be per day? They would just draw down on inventories?

Mr. EASTON. They would continue to have their inventories and refine the products that they have. The current refining rate depends on the season of the year and what products they make, but that would continue.

CIA ESTIMATES

Mr. DICKS. You were going to have one of your colleagues talk about the——

Mr. EASTON. Guy Caruso led our efforts from DOE on the size study, and perhaps he can tell you what went into the CIA estimates.

Mr. CARUSO. What we asked the CIA member of the working group to do was to focus on the incremental 250 million barrels, going from 750 to a billion. What we were seeking from them was: "What would be the likelihood and the duration of a very large disruption where we would need to go beyond the 750 million barrels?" As Mr. Easton has already pointed out, that already provides us with a substantial amount of coverage.

For example, currently we could draw down 3.5 million barrels a day. Once we reach 750, we'll be able to draw down at 4.5 million barrels a day. In addition, there are strategic stocks held by our IEA allies, and there is also some unused productive capacity around the world, some of which would still be available.

So taking all of these things into consideration, the CIA's assumption used for the study was a large enough disruption that would go beyond the capability of the 750 million barrel SPR, plus the use of our allies' stocks which we could rely on. Such a large disruption, which is more than 10 million barrels a day—if we put that in perspective—the Iranian disruption in 1979 was 3.7 million barrels a day—would be three times larger than anything we've ever experienced. The probability of such a disruption in the CIA's assessment was about 1 percent per year.

PREVIOUS DISRUPTIONS

Mr. DICKS. All right. For the record, describe the size and duration of previous market disruptions and how that affects the probability of your worst-case assumptions. You've done one of them. Compare this probability to previous studies, such as the 1988 Oak Ridge study.

Mr. CARUSO. The two disruptions we're most familiar with are the 1973–1974 Arab oil exporting countries' embargo, which took about 1.7 million barrels a day off the market for roughly five to six months. The other one was the Iranian revolution of 1978–1979, which I already mentioned, which took 3.7 million barrels a day of oil off the market for about six months.

Disruptions of that size would have a much higher probability than the very large disruption which I mentioned earlier that the CIA focused on for this study. Those size disruptions were also included in the cost benefit analysis. As I mentioned, these disruptions would be covered by existing strategic petroleum stocks in the United States and elsewhere, so that in effect you would not need to ever use your fourth 250 if the disruption sizes stayed as small as the previous ones. They would have a larger disruption probability, but they would not be a convincing factor in the fourth 250 increment.

The Oak Ridge study of 1988 used probability assumptions, which were derived in some fashion by the contractor themselves. There was not any interagency involvement or even, to my knowledge, internal DOE agreement on those probabilities. I might ask if Howard Borgstrom has anything to add to that.

[The information follows:]

PREVIOUS DISRUPTIONS AND PROBABILITIES OF FUTURE DISRUPTIONS

In response to the first part of your request, I am providing Table IV-1 from the 1990 interagency study: Strategic Petroleum Reserve: Analysis of Size Options, which was transmitted to Congress on February 2, 1990.

The study concentrated on severe oil supply disruptions involving sharp reductions in world oil production that were 2 to 4 times larger than the largest 1970s interruption. The disruption sizes and estimated probability of occurrence of these scenarios were supplied by the CIA. The most critical part of the CIA's analysis was the assessment of likelihood of these cases occurring, since the projected benefit of the increased SPR is weighted by the annual likelihood of an oil supply disruption. The CIA approached the likelihood problem by combining an examination of past oil supply disruptions with qualitative analysis of important oil market and regional trends. The study group then used statistical techniques and probability distributions to synthesize the historical data with CIA evaluations of as yet unobserved events.

The reason that "worst case" disruptions were used, rather than basing probabilities strictly on the level of past disruptions, was that the largest of the past disruptions could be handled today by current worldwide strategic storage. Since the study focussed on options to expand the Strategic Petroleum Reserve beyond 600 million barrels, the disruptions that we analyzed would require increments of strategic storage beyond what are currently available, and therefore would be considered "worst case" assumptions. Over the past 30 years, the largest interruption (the 1978/79 Iranian Revolution) was less than half the size of the smallest CIA-defined worst case for the 1990 study.

In this respect the 1990 interagency study was not unique. The three studies referred to below concentrated on worst-case disruptions well beyond the interruptions of the 1970s, the most severe of which was the 1978/79 Iranian Revolution: 3.7 million barrels per day for 6 months. The 1986 and 1990 interagency studies derived their "major" (1986) or "worst case" (1990) disruptions from specific scenarios. The 1988 Oak Ridge National Laboratory (ORNL) study disruption sizes were derived from generalized estimates of non-deliberate OPEC disruptions with the largest loss of OPEC capacity resulting from use of unconventional weapons.

- o 1986 Interagency Study. The largest gross disruption considered by the 1986 study was on the order of 13 million barrels per day. The scenario driving the worst case disruption size was closure of the Strait of Hormuz.

- 1988 ORNL Study. The largest net disruption size in the 1988 ORNL study was 15 million barrels per day, which was one of three scenarios; the maximum disruption size in the other scenarios was 10 million barrels per day. The scenario driving the 15 million barrel per day worst case disruption size was use of unconventional weapons in a major local war in the Middle East.

- 1990 Interagency Study. The 1990 interagency study considered a continuous range of disruptions from zero to over 25 million barrels per day. Shutdown of two of the largest Persian Gulf oil producers was a scenario that justified the larger, low probability disruptions.

The probability differences between the studies are not easily comparable because of differences in model structures and related assumptions. They are, however, quite large; the 1986 interagency study and the 1988 ORNL study probabilities envision a much greater likelihood of a worst case supply disruption than does the 1990 interagency study.

The 1990 interagency study, based on a CIA assessment, assumes that the probability of a worst case disruption is substantially lower than the probability used in the 1988 ORNL study. CIA analysts approached their contribution by first formulating a set of scenarios that bracketed their best sense of reasonable "worst cases" of oil supply disruptions that might occur through the 1990's. Then, to provide general probabilities of these cases occurring, the CIA combined an examination of past oil supply disruptions with current qualitative analysis of important oil market and regional trends. At the request of the interagency group, the CIA refined its probabilities by surveying several Agency oil market and Middle East experts on the likelihood of its least severe case occurring during the period 1995-2010. The responses ranged between a cumulative 3 and 10 percent over the 15-year period. The conclusion provided to the interagency group was that the likelihood of the Agency's least severe case occurring between 1995 and 2010 is 10 percent, plus or minus 5 percentage points. Study group statisticians then fit a Weibull probability distribution curve to both the historical data on disruptions provided by the CIA and the CIA projected probabilities of future disruptions. The resulting "set" of probabilities is consistent with the historical occurrences of oil supply disruptions and the CIA assessment of disruptions through the 1990s.

The ORNL probability calculations were not based on intelligence estimates nor were they provided to other agencies for review. As far as can be determined, the probability estimates used by the ORNL study did not take into account oil market or Middle East political, military, or economic factors that would underlie any significant oil supply disruption.

Putting the studies on a comparable basis (annual probability of a gross event) involves some reformulation of each study, so that none of the probability statements listed below can be found in the associated study.

- 1986 Interagency Study. The most clearly comparable statement of probability to the other studies is that a major disruption (gross 6 to 13 million barrels per day) had annual probabilities of 0, 5, and 10 percent for optimistic, moderate, and pessimistic expectations.
- 1988 ORNL Study. The ORNL study probabilities are quarterly, but are embedded in complex "transition matrices" defined for each model. The major disruption cases are three: two of gross 10 and one of gross 15 million barrels per day with computed annual probabilities (for comparability with the 1986 and 1990 studies) of 3.9, 4.1, and 21.5 percent respectively.
- 1990 Interagency Study. The 1990 study probabilities are annual. For comparability with earlier studies that used point estimates of disruptions, major disruption ranges can be determined; two of gross 7.5 million barrels per day and larger, and one of gross 11.5 million barrels per day and larger with annual probabilities of 0.5, 1.1, and 0.6 percent representing optimistic, mid case and pessimistic expectations respectively.

Under the 1988 study probability assumptions, there would be a 50/50 chance of a worst case net supply disruption every 1 to 3 years. Whereas, under the 1990 study assumptions, the probability of such a worst case disruption does not reach 50 percent over the entire 30 year projected period of the study. Only the 1990 study used intelligence agency estimates of the size and likelihood of disruption; the 1988 study relied on contractor estimates while the 1986 study probabilities were negotiated estimates by eight participating agency staffs.

Table IV-1
PAST DISRUPTIONS OF OIL PRODUCTION
PERCENT CHANGE IN WORLD OIL PRICES

Dates		Duration (in Months)	Magnitude Of Supply Shortfall (Million b/d)	Percent Change in World Oil Prices (US$/barrel)
March 1951 - October 1954	Iranian Fields Nationalized. Iranian oilfields were nationalized on May 1, following two months of unrest and strikes in the Abadan area. Major oil companies boycotted Iranian oil on the world oil market and instituted court actions to deter potential buyers.	44	0.7	+12.9 (1.71 to 1.93)
November 1956 - March 1957	Suez War. Nasser closed the Suez Canal in the wake of the Anglo-French-Israeli incursion. At the same time, the Iraqi Petroleum Company (IPC) pipeline was damaged in Syria, and Saudi Arabia embargoed oil shipments to the United Kingdom and France.	4	2.0	-1.6 (1.93 to 1.90)
December 1966 - March 1967	Syrian Transit Fee Dispute. Syria imposed new transit taxes on the IPC pipelines to the Mediterranean. IPC stopped the flow of oil, refusing to pay the higher taxes. Iraq demanded full revenues from the oil companies operating there, despite the diminished production.	3	0.7	No Change (1.35)
June 1967 - August 1967	Six Day War. Suez Canal closed, and IPC and Tapline pipelines shut down following the Israeli strike into the Sinai. Oil exports were embargoed to Western Europe--particularly to the United Kingdom, West Germany, and the United States.	2	2.0	No Change (1.35)
July 1967 - October 1968	Nigerian Civil War. Oil terminals were blockaded by the Nigerian Federal Navy, chocking off exports. Shell and BP ceased production in the country during most of the war.	15	0.5	-3.7 (1.35 to 1.30)
May 1970 - January 1971	Libyan Price Controversy. Libya gradually reduced the authorized production by selected oil companies, claiming potential damage to the oilfields. At the same time, the Tapline was damaged in Syria, forcing a shutdown until Syria authorized repairs. Production cuts were restored, and the pipeline in Syria was quickly repaired once Libya obtained higher oil prices from the companies.	9	1.3	+25 (1.94 to 2.42)

Dates		Duration (in Months)	Magnitude Of Supply Shortfall (Million b/d)	Percent Change in World Oil Prices (US$/barrel)
April 1971 - August 1971	Algerian-French Nationalization Struggle. Algeria nationalized 51 percent of the oil companies and pipelines--all French owned--operating within its borders and announced compensation plans. The Algerians then unilaterally raised oil export prices to French firms, leading the companies to seek a worldwide embargo against Algerian oil. Algeria retaliated by suspending oil deliveries to French tankers, claiming that the companies owed back taxes. Oil flows resumed in August after a CFP-Algerian agreement in July. All other companies accepted the Algerian terms by December.	5	0.6	No Change (1.75)
March 1973 - May 1973	Lebanese Political Conflict. Unrest in Lebanon disrupted the flow of oil from Iraq and Saudi Arabia. Following a Lebanese takeover of IPC facilities near Tripoli, Iraq cut off oil exports to Lebanon and was denied use of Lebanon's transit facilities. In April, a storage tank and parts of the Tapline facility at Sidon were destroyed by sabotage.	2	0.5	+26 (2.30 to 2.90)
October 1973 - March 1974	The October Arab-Israeli War. OAPEC embargoed oil shipments to selected Western countries and reduced oil production. Transit through the Suez Canal was halted, further delaying shipments to the United States and Western Europe. OPEC production returned to the level of October 1973 in the first quarter of 1974. Saudi Arabia finally ended the embargo on 18 March 1974.	5	1.6	+276 (3.04 to 11.34)
April 1976 - May 1976	Civil War in Lebanon. Political instability in Lebanon led Iraq to reduce oil exports via the pipelines through Lebanon to the Mediterranean.	2	0.3	No Change (11.50)
May 1977	Damage at a Saudi Oilfield. Fires damanged a gas-oil separation facility at Saudi Arabia's Abqaiq field. Repairs took nearly one year, but other Saudi production quickly offset the loss.	1	0.7	No Change (12.70)

Dates		Duration (in Months)	Magnitude Of Supply Shortfall (Million b/d)	Percent Change in World Oil Prices (US$/barrel)
November 1978 - April 1979	Iranian Revloution. Unrest in the oilfields shut down production during the fourth quarter of 1978 and the first quarter of 1979. Output was gradually restored to around 4 million b/d starting in May 1979.	6	3.7	+82.4 (12.91 to 23.55)
October 1980 - January 1981	Outbreak of Iran-Iraq War. The Iraqi-initiated regional conflict sharply curtailed oil exports from both countries, particularly through the Persian Gulf. There were intermittent air attacks and sabotage damage to export terminals, processing facilities, and pipelines in both countries.	3	3.0	+9.8 (31.74 to 34.84)
July 1988 - August 1988	UK North Sea Piper Alpha Platform Explosion. A gas explosion completely destroyed the Piper Platform, killing 167 people while stopping exports of over 300,000 b/d from the Flotta onshore terminal. Reconstruction of the Piper platform is not expected until 1992. Production of about 35,000 b/d from surrounding platforms has been successfully restored.	2	0.3	+23.4 (14.41 to 17.78)
December 1988 - March 1989	UK North Sea Fulmer Floating Storage Accident. The Fulmer floating storage vessel broke away from its moorings damaging the export facilities there and halting oil flow. Temporary repairs restored 100,000 b/d in March 1989.	4	0.2	+7.9 (16.13 to 17.40)
April 1989 - June 1989	UK North Sea Cormorant Central Platform Explosion. A gas leak and explosion at the key UK North Sea Cormorant Central platform stopped production of over 500,000 b/d. Partial production presumed in June 1989.	2	0.5	-17.48 (18.99 to 17.48)

PROBABILITY OF A DISRUPTION

Mr. **Borgstrom**. I believe on an apples-to-apples basis, the probabilities used in the mid-case in the 1988 Oak Ridge National Laboratory study would have been approximately four times the probabilities that were used in the 1990 interagency study.

Mr. **Dicks**. Which one do you agree with?

Mr. **Borgstrom**. Excuse me?

Mr. **Dicks**. Which one do you agree with?

Mr. **Borgstrom**. Personally, I believe that the 1988 study overestimated the likelihood of a disruption.

Mr. **Dicks**. What was the underpinning for their assessment in 1988? Why did they think there would be larger disruptions?

Mr. **Borgstrom**. They actually did not discuss the rationale behind the different probability matrices in any depth in the study itself. I believe that some of them were taken——

Mr. **Dicks**. How much did we pay for this study? [Laughter.]

Mr. **Borgstrom**. We have a modeling capability at the Oak Ridge National Laboratory that maintains a number of models, so it was the ongoing use of the existing staff there.

Mr. **Dicks**. All right. What do you think, Mr. Secretary?

Mr. **Easton**. I'm persuaded, from what I know of the 1988 study and what I know of our present study, that the present study, the disruption scenario is based, instead of on a model as Howard referred to, on live intelligence from the CIA, current thinking about what the oil market of the world is like. The study also had, as we've mentioned, the concurrence of a number of other agencies, security agencies and——

PRIVATE SECTOR VIEWS ON SIZE STUDY

Mr. **Dicks**. Okay. Let me ask you something. Agencies are fine. The Government is fine. What does the private sector think? Do we have any advisory group that you've talked to in the private sector amongst the oil companies about these conclusions? Do we bounce this off of anybody in the private sector to get their reaction to it?

Mr. **Easton**. I don't think that the private sector participated extensively in either one of the two studies. I have had some personal conversations with some members of the private sector that would like to see a billion barrels.

Mr. **Dicks**. Why? What would be their reason for that?

Mr. **Easton**. Perhaps——

Mr. **Dicks**. Would they like to sell it to the Government?

Mr. **Easton**. They may see some more business opportunity to it.

Mr. **Dicks**. But have there been any studies outside of the Government that have looked at this question and come up with different conclusions?

Mr. **Easton**. I'll return to Mr. Borgstrom, but we think some of the earlier studies, were done by professors at Harvard and elsewhere, so they would be private in that sense, or non-Government.

Mr. **Borgstrom**. There have been studies done outside the Government, as Mr. Easton says, mostly in the academic world. The National Petroleum Council has been asked for their opinions from time to time on different aspects of the SPR. I believe they were consulted particularly in the 1970s on that subject, although there is no recent report from them on the size of the SPR.

STRATEGIC PETROLEUM RESERVE DRAWDOWN

Mr. DICKS. All right. Just for my own personal information and for the Committee's, how do you work out who gets what if there is an emergency? Who gets what out of this? How would you make allocation decisions? Can you describe that just generally for me?

Mr. EASTON. I can. It's generally a market-oriented disposition of the oil.

Mr. DICKS. Who needs it, in other words?

Mr. EASTON. The highest bidder bids what the going market price is to obtain the oil. There is the ability for the Secretary to direct a portion of the oil. That is sort of a last resort authority, but generally the primary disposition would be through auction, through bidding, with the backup authority of the Secretary to direct a portion of it.

Mr. DICKS. As I assume you know, this Committee has questioned consistently the lack of standby plans for allocation of energy, in general, and the Strategic Petroleum Reserve, in particular, in the case of energy emergencies. Since last year's hearings, have you considered any modifications to the authorities available with regard to the use or allocation of SPR oil?

Mr. EASTON. We have. I think——

Mr. DICKS. What do you think of that criticism generally?

Mr. EASTON. If the criticism is suggesting that we should have the authorities we had in the 1970s, such as the ability to control prices and allocations, we find that that sort of authority would present more problems than it is worth. On the other hand, if the criticism is directed at some fine tuning, I think we, ourselves, are looking at some of the fine tuning, such as pre-drawdown diversion, diversion of oil in transit to the SPR, that could be done without having to have a Presidential declaration, streamlining our ability to amend the distribution and draw-down procedures without having to go through formal rulemaking, giving ourselves the opportunity to export SPR oil to Caribbean refineries in order to put that into the Northeast markets. So we are looking at fine tuning and increasing our authorities in some of those areas, and we would agree with those who say we might need some additional authority. We are looking at those, and we support several of the legislative proposals that give us those authorities.

Mr. DICKS. Now, I understand that there is legislation pending to make some changes. Are any of the proposals you have just mentioned part of this legislation?

Mr. EASTON. Yes, Mr. Chairman, they are. Both on the House side and the Senate side, there are proposals as part of the EPCA extension, that would allow for this pre-drawdown diversion of oil in transit, that would allow us to export oil for refinery in the Caribbean, and that would streamline our ability to amend the distribution plan. So there are a number of proposals that the Department does support.

Mr. DICKS. Okay. Do you think that the reserve should be available for domestic emergency?

Mr. **Easton**. Yes. That is one I neglected to mention, that we would recommend that it be available for domestic emergencies.

Mr. **Dicks**. Just hypothetically, what kind of an emergency might that be?

Mr. **Easton**. I think the best example would be had the oil spill in Alaska resulted in an extensive closure of the pipeline, that would have been the domestic type of interruption that we would have liked to have been able to have the authority to use the SPR, had that pipeline been closed for a significant period of time.

Mr. **Dicks**. Under current law you can't do that?

Mr. **Easton**. The current law allows us only for imported oil, sabotage, or an act of God, and so outside of sabotage or act of God, the emergency has to result from the disruption of imported oil.

Mr. **Dicks**. Do you think the President, through the Secretary, should be able to allocate oil or oil products, either from the reserve or from general supplies if the market fails in an emergency?

Mr. **Easton**. I mentioned that we have a capacity to direct some of that oil now in the extreme situation. I don't think we want to get into having total authority, just say, "Well, we're going to invoke the SPR because prices are starting to run up." Part of the run up in prices actually is helpful in directing oil or oil products, because when the higher prices occur, supply goes to where the prices run up, and then it brings the system back into sync.

Mr. **Dicks**. Okay. Are there any current provisions, in conjunction with the sale of Strategic Petroleum Reserve oil, to assure domestic use of the oil sold?

Mr. **Easton**. At the moment, I don't think we have anything on the books that would require that or ensure that. One of the factors that we must keep in mind is that we could well be triggering the use of the Strategic Petroleum Reserve as part of our obligations under the International Energy Program. Under the IEP, which is the sharing of oil, we may well want some of that oil to be used by our partners in the International Energy Agency.

RESALE OF SPR OIL

Mr. **Dicks**. Are there any provisions limiting resale of the oil to others by the buyer?

Mr. **Easton**. I know of none that we have on the books.

Mr. **Dicks**. Do you think we need any policies in this area to try to ensure that if there are some priority decisions made that domestic requirements should be taken care of first before we take care of——

Mr. **Easton**. I don't think so because the——

Mr. **Dicks**. In other words, let's say that we get into an emergency—could you condition your sales? Do you have the authority to do that so that you could say, "Now listen, we need to take care of domestic refineries in this part of the country first. If you were going to bid on this, this has got to be taken care of first, we don't want you to buy it and sell it to Canada, or Britain, or somewhere else."

Mr. **Easton**. I think that that sort of control would be difficult to exercise for the following——

Mr. **Dicks**. We have bidding procedures on everything.

Mr. EASTON. Sure. Under today's authority, we can reject a bid. If we find a bid that is inimicable to the U.S. interest, we could reject that bid. On the other hand, we also have certain laws that prohibit the export of, for example, Alaskan oil and the NPR oil. There are current laws that apply to the export of that oil, so you can stop the export of that portion of the Strategic Petroleum Reserve. That is one of the reasons, for example, we're seeking the explicit authority to export SPR oil to Caribbean refineries so it can be refined and then put up into the Northeast.

What I have trouble trying to figure out is how you would write a rule or a regulation that would prejudge the use to which that——

EXPORT OF SPR OIL

Mr. DICKS. Well, I'm not saying prejudge it in a rule or regulation. What I'm saying is could you, when you do a contract—I mean, you said you're going to have a bidding system, right? You're going to auction off to the highest bidder "X" amount of oil. I think you could condition that and say, "If you're going to bid on this oil, you've got to take care of domestic deficiencies first." It seems to me that would be totally rational. I don't think the people of this country would be very thrilled about a situation where the Department of Energy is going to let somebody in an emergency, when oil imports are being cut off, take the oil from the SPR and export it. I mean, I think you'd have a lot of Congress on your case on that one.

Mr. EASTON. As I mentioned, because there are limitations under the law already about exporting Alaskan oil or NPR oil, the ability to export SPR oil was pretty limited already.

Mr. DICKS. Are you telling me you don't have the authority?

Mr. EASTON. No. I'm not saying that——

Mr. DICKS. I'm not asking whether you're going to do it or not, but do you have the authority?

Mr. EASTON. Howard, you've looked at some of these issues. Do you want to discuss some of the analysis we've gone through in deciding whether we wanted to apply this or not?

Mr. BORGSTROM. What Mr. Easton is referring to is the fact that there are general export control laws covering crude oil.

Mr. DICKS. All right.

Mr. BORGSTROM. There are possibilities, not just with the Department of Energy, but also other agencies to control the export of crude oil under different circumstances. It presumably would be possible to have that associated with a sales provision as well. However, the Administration has requested legislation that would permit, on a limited basis, export of SPR crude oil, such as to Caribbean refineries.

Mr. DICKS. I don't have any problem with that because you're going to refine that oil and then it's going to come up to the Northeast. I don't have a problem with that because it is meeting the domestic requirements first. I would have a problem if we sent oil down to the Caribbean refineries, and they refined it, and then sold it to the British and sent it to England when we had requirements in the United States that were going unmet.

I don't think that would go down. I think you'd have a real problem. What you're telling me is that that situation could occur under existing law. You have no regulations to deal with that. Is that correct?

Mr. **Borgstrom**. It's highly unlikely that it would occur because of the general barriers on exporting oil in terms of the controls imposed by, I believe, the Department of Commerce.

Mr. **Dicks**. Okay. So you're saying under the export licenses that this can be dealt with and that it's not a big problem.

Mr. **Borgstrom**. I believe so.

Mr. **Dicks**. Are you a lawyer? [Laughter.]

Mr. **Borgstrom**. No.

Mr. **Dicks**. You sound like one. [Laughter.]

SPR SIZE STUDY ASSUMPTIONS

Why don't you flesh out in the record here what the rules and regulations are regarding this subject, so we know where we stand on this, okay?

[The information follows:]

CONTROLS ON STRATEGIC PETROLEUM RESERVE OIL EXPORTS

During a Strategic Petroleum Reserve (SPR) drawdown, the Department of Energy (DOE) would work closely with the Department of Commerce, which is responsible for issuing crude oil export licenses, to assure that no exports of SPR crude oil occur in a manner inconsistent with national policy decisions about the destination of that oil. There is ample legal authority to restrict crude oil exports: tight crude oil export restrictions presently are in place, with the single significant exception of exports to Canada; and an administrative mechanism now exists for implementing policy decisions to restrict SPR crude oil exports in an emergency.

There is broad authority to control crude oil exports under several statutes, among them section 103 of the Energy Policy and Conservation Act (EPCA), 42 U.S.C. 6212. At present, the export of crude oil, including crude oil stored in the SPR, is governed by the Department of Commerce's "Short Supply Controls," 15 C.F.R. Part 777. Under these regulations, no crude oil may be exported from the U.S. without a "validated license" issued by the Commerce Department. The regulations effectively control the export of all SPR crude oil, regardless whether previously imported or domestically produced.

The Commerce Regulations generally permit the export of previously imported crude oil only under very limited circumstances, of which the most relevant to SPR exports is that in which: the export is part of a transaction resulting in the importation of refined products of a quantity and quality not less than would be derived from domestic refining; the products are to be sold at prices no higher than the lowest prices at which they could have been sold by the nearest capable U.S. refinery; and for compelling economic or technological reasons beyond the exporter's control, the crude oil cannot reasonably be processed in the U.S. (section 777.6(d) (1) (vii)).

There are even more stringent, independent statutory tests to be met as preconditions to the export of domestically produced crude oils, including Alaska North Slope (ANS)* and Naval Petroleum Reserves (NPR) oil. See section 7(d) of the Export Administration Act of 1979, 50 U.S.C. 185(u) (oil shipped across a Mineral Leasing Act section 28 right-of-way) and 43 U.S.C. 1354(a) (Outer Continental Shelf).

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* In June 1986 the Secretary of Commerce made the necessary national interest determination under section 103 of the EPCA to authorize the export from Alaska of Cook Inlet Oil, which, unlike ANS crude, is subject only to the Short Supply Controls. Subsequently the Commerce Department amended its regulations to implement the export authorization. 50 F.R. 26145 (June 25, 1985) and 51 F.R. 20252 (June 4, 1986). At this time there is no CookInlet crude oil stored in the SPR.

More liberal treatment is afforded crude oil exports to Canada. In June 1981, President Reagan determined that the export of crude oil (other than ANS and NPR oils) to Canada for use or consumption in Canada is in the national interest and made the necessary findings under section 103 of the EPCA, section 28 of the Mineral Leasing Act, and section 28 of the Outer Continental Shelf Lands Act to permit such exports. The President's decision to permit the export of crude oil to Canada followed a March 18, 1985, Trade Declaration between the President and Canadian Prime Minister Mulroney providing for the reciprocal relaxation of U.S. and Canadian oil export restrictions. Subsequently, the U.S. agreed in the U.S.-Canada Free-Trade Agreement (FTA), which went into force January 1, 1989, to allow the export to Canada of up to 50,000 barrels per day of ANS crude oil, subject to a requirement of ocean carriage on U.S.-flag vessels. The U.S. implementing legislation for the FTA, Public Law No. 100-449 (September 28, 1988), authorizes these exports in section 305(a), amending the Export Administration Act, and the Commerce Department has published implementing regulations. 55 F.R. 10051 (March 19, 1990). An exporter continues to need to obtain a validated license from the Commerce Department for crude oil exports to Canada, but under normal circumstances it is routinely issued for qualifying crude oil. Although there has been no indication of a likelihood that SPR oil will be delivered to Canada in an emergency, this hypothetically is possible, and it is possible physically to deliver SPR oil to Canada either by pipeline or by water. Any new restrictions on exports of crude oil to Canada would need to be imposed in a manner consistent with the provisions of the FTA, which allows export restrictions in short supply circumstances only if they do not reduce the proportion of the export good relative to the total supply of the good.

A complicating factor with respect to crude oil that is stored in the SPR is that oils subject to the disparate legal export criteria, such as previously imported, ANS, NPR, and other domestic oils, are commingled in storage, and could become even more commingled during drawdown. Thus, it may be difficult for a buyer to know, or for the Department of Energy to inform the buyer, which export control laws the oil he is buying is subject to. This adds to the difficulty of exporting SPR oil.

It should be noted that, because the Department of Energy believes that legislation with respect to export controls that affect SPR crude oil is necessary in order to maximize SPR distribution flexibility, the Department has recommended enactment of authority to permit the export of SPR oil for the limited purpose of facilitating oil exchanges or processing agreements to supply the U.S. with needed refined petroleum products. This underscores the point that SPR crude oil, rather than being at significant risk of export, is to the contrary unduly restricted from export uses that could result in augmenting refined product supplies within the U.S.

Mr. DICKS. In addition to the use of the Strategic Petroleum Reserve in a disruption, the study assumes the use of foreign reserves, excess capacity, and fuel-switching ability. How much protection does each of these additional sources add? Do we know?

Mr. EASTON. I don't think we did quantify it in the study. They are all qualitative factors that exist today that didn't exist in 1973 and 1974. We did not have our emergency energy program through the IEA. We did not have some of the capabilities that we have today, so these are qualitative factors; we simply didn't quantify them.

Mr. DICKS. Mr. Caruso, do you want to explain them?

Mr. CARUSO. Certainly. There were three offsetting factors, one of which we already talked about. That is our own strategic reserve which, as we said, initially could be drawn down right now at 3.5 million barrels per day, and at 750 million barrels, it could be drawn down at 4.5 million barrels per day. In addition to that, there was an assumption agreed upon by the working group that——

Mr. DICKS. Hold one second. Let me ask you on that point—do we have the equipment in place to get the oil out of these facilities? It is operational? We've tested it? We can do it?

Mr. CARUSO. Yes.

Mr. DICKS. All right. Go ahead.

Mr. CARUSO. In addition to that, there were assumptions made in the study which varied by year. It wasn't the same every year. The study goes out to the year 2020. In the period that matters for the 750 to a billion increment, which is 1995 to 2010, when we'd be reaching these higher levels of SPR, the assumption was made that there would be 3 million additional barrels per day of allied strategic stocks available for drawdown during a disruption. This primarily would be strategic Government-owned and controlled stocks in other IEA countries, particularly in Japan and Germany. One assumption was, in the mid-case, 3 million barrels a day would be drawdown by our allies.

The other offset you mentioned was fuel switching. There is the capability of moving from oil to other fuels, currently, of about 500,000 barrels a day. The mid-case assumption in the study was 350,000 barrels a day fuel switching in the outyears.

The third offset was unused productive capacity that might be available during a disruption. Based on estimates of productive capacity around the world by our Energy Information Administration, and by the CIA, on a year-by-year basis, we estimated the various amounts of oil that might be available during a disruption from other producing countries that were not disrupted.

We took the scenario and just for the purposes of hypothetical explanation, if the country that was disrupted was Iran, you assume zero from Iran, of course, so there is no productive capacity available from Iran, but there might be oil available that wasn't being produced from Saudi Arabia. For the mid-case assumptions we used about 80 percent of unused, undisrupted productive capacity that was assumed to be available at the time of the disruption. Those numbers range in the mid-case from three million to five million barrels a day, depending on the year.

Mr. DICKS. All right.

Mr. CARUSO. In the outyears, they were smaller. Because of the great uncertainty on all of these issues, we had a range, a low, a mid, and a high. In the low case, we assumed very little unused productive capacity would be available.

Mr. DICKS. Okay. Now flush that out for the record. Anything you want to add there, you know, to give the committee a better understanding of how you reached these assumptions and how confident you are of the underlying rationale. Put that in the record.

[The information follows:]

SPR SIZING STUDY ASSUMPTIONS

In this part of the analysis a certain volume of oil is assumed to be available during a disruption which can be used to offset the effects of some of the disrupted supplies. This oil comes from one of three sources which include foreign stocks, excess crude oil production capacity, and fuel switching from oil to gas. Both Japan and West Germany hold or control large quantities of oil which can be used during a disruption.

In the mid case between now and 1995, it is assumed that 2 MMBD of these stocks can be drawn down and after 1995 the rate increases to 3 MMBD. At present, there is significant excess crude oil capacity throughout the Middle East.

Although this excess capacity is projected to decline over time depending on the assumed production capacity utilization and the area of disrupted supplies, there should, in most cases, be some amount of excess capacity available to offset a disruption even in the distant future. The assumptions for this excess capacity are explained in the table which follows. In addition, during a crisis some oil users will be able to switch to natural gas.

In this analysis, it is assumed that fuel switching could reduce oil demand by 350 thousand barrels per day from 1995 forward. In this analysis, it is assumed that all of the excess capacity, foreign strategic stocks, and fuel switching supplies will be made available at the outset of a disruption. There is, however, a range of values for these factors that is considered in the sensitivity analysis. All of these factors can be used to reduce the gross oil disruption and thereby reduce the volume of SPR oil needed during a disruption. These factors (U.S. strategic and foreign stock draws, excess production capacity, and fuel switching) account for the difference between a gross disruption and the actual oil shortage.

TABLE 1.—DISRUPTION OFFSET ASSUMPTIONS

[Million barrels per day]

	1990	1995	2000	2005	2010	2015	2020
Excess capacity:							
Low	3.5	3	2	1.5	0.5	0.5	0
Mid	5	6	5	4	3	2	1.5
High	6.5	6	5	4.5	4.0	3.5	3.5
Foreign stock draws:							
Low	1	1	2	2	2	2	2
Mid	2	2	3	3	3	3	3
High	2.5	2.5	3.5	3.5	3.5	3.5	3.5
Fuel switching	.5	.35	.35	.35	.35	.35	.35

TOTAL OFFSET RANGE

[Million barrels per day]

	Low	Mid	High
1990	5	7.5	9.5
1995	4.35	8.35	8.85
2000	4.35	8.35	8.85
2005	3.85	7.35	8.35
2010	2.85	6.35	7.85

TOTAL OFFSET RANGE—Continued

[Million barrels per day]

	Low	Mid	High
2015	2.85	5.35	7.35
2020	2.35	4.85	7.35

Mr. **Caruso**. Certainly.

EXCESS CAPACITY ESTIMATES

Mr. **Dicks**. How confident are you of estimates of excess capacity given increasing OPEC production?

Mr. **Caruso**. We're reasonably confident that the numbers that were projected by IEA and CIA for productive capacity will be achieved.

INTERNATIONAL EMERGENCY AGREEMENTS

Mr. **Dicks**. All right. What requirements are there for other countries to use their reserves in a disruption? Well, are there any agreements with them on what will be done and how that will be done?

Mr. **Caruso**. As Mr. Easton mentioned early on in his oral remarks, there are the coordinated emergency response measures, which we have been working hard in the IEA to develop. We feel that we have commitments from our allies in the IEA to utilize strategic stocks early and in large volumes in a disruption even if it was not large enough to trigger the IEA emergency sharing system.

Mr. **Dicks**. How effective do you project International Energy Agency agreements will be in getting others to use their reserves? How comfortable are you with that, Mr. Secretary?

Mr. **Easton**. I feel more comfortable after participating in this conference that I mentioned in my oral remarks. Last fall the International Energy Agency, at our urging, conducted a stocks conference in which we spent three days reviewing how it would work, some of the mechanics of stock build and stock draw, and after participating in that conference and hearing the presentations from some of the other countries, as well as their commitments expressed in that conference, I feel much more comfortable that this international energy program would work and is actually going to be a more effective vehicle than the alternate program which is another part of our emergency action. That is called the demand reduction side. A number of countries feel they can reduce the demand should there be an emergency.

Mr. **Dicks**. How do those countries that do not have large reserves, expect to handle a supply disruption?

Mr. **Easton**. That's been one of our contentions with our colleagues who don't have stocks is that they feel they can handle disruption through demand reduction. The IEA has run a number of tests, called allocation systems tests, which actually invoke these reductions in demand throughout the OECD countries that believe in that. We feel that, although that is a useful alternative, there is nothing that suffices as well as having stocks. The answer to the question is that those IEA countries that don't have stocks consider that they can meet their requirements through reducing demand.

Mr. DICKS. Do you believe that is viable?

Mr. EASTON. We think that, obviously, there will be certain conservation and demand reduction when there is less supply available. A natural consequence of any sort of interruption or disruption is, that if it's not there, you are going to conserve and reduce. Certainly there is a basis for that premise that they can reduce their demand.

Our concern, however, is that nothing works alone, and we think that demand reduction should occur with the use of stocks. We would like to see all of our IEA allies build stocks, as well as depend on demand reduction.

Mr. DICKS. Now the countries with large reserves, though, are Japan and Germany?

Mr. EASTON. That's correct.

Mr. DICKS. Anybody else?

Mr. EASTON. Well, some of the IEA countries are net exporters, and so they don't have to keep stocks. That would be Norway, U.K., and Canada; they would have exports over imports, so you should consider those, as well as the U.S., Germany, and Japan.

Mr. DICKS. Do we have bilateral agreements only with Japan and Germany?

Mr. EASTON. Well, we have a number of bilateral relationships with a number of other countries outside of oil sharing, if that's——

Mr. DICKS. No. I'm talking about specifically on the oil sharing issue.

Mr. EASTON. I think the fundamental agreement is the IEP—the International Energy Program—through the IEA. All the IEA countries are signatories to that, so that is a multilateral agreement that determines how the oil will be shared.

Mr. DICKS. Okay. Right. Anything else you'd like to say about the Strategic Petroleum Reserve at this point?

Mr. EASTON. I've hogged all of the answers. Anybody else here at the table want to clarify anything I've said or add to it?

Mr. DICKS. Okay. We understand that some of the people here were involved in the Strategic Petroleum Reserve and have another hearing to attend.

Mr. EASTON. That's correct.

Mr. DICKS. If that is the case, why don't we let those people go ahead, and then we'll go on to other areas.

ENERGY EMERGENCY RESPONSE ACTIVITIES

Let's talk about emergency response. In 1989, there were two major disasters in the United States, Hurricane Hugo and the Loma Prieta earthquake in San Francisco. For each of these occurrences, please explain what actions the Department of Energy took.

Mr. EASTON. Our Office of Energy Emergencies was very much involved in both of those, and I think in contrast to the actions we took in the past, we were much more hands-on in both of these emergencies. Perhaps the easiest way of describing what we did is to contrast what we might have done a few years ago. A few years ago, we would have monitored, collected data, collected information, perhaps shared it, but would not have been out in the field trying to determine what resources might be necessary to restore vital energy service.

In these two situations, both the hurricane and the earthquake, we had representatives from the Office of Energy Emergencies, electric utility experts and gas experts, go to the scene and work with the local utilities to determine what resources were needed in terms of either equipment or personnel. For example, after one of our specialists was on the scene in Puerto Rico, we worked very hard to make sure that DOD got the C5 to bring in the generation capacity to Puerto Rico and the Virgin Islands.

When we were both in South Carolina with the hurricane and in California with the earthquake, and my Deputy Assistant Secretary for Energy Emergencies was on-scene in California, we were working with the utilities to determine whether any of our electric experts from our power administrations, from Bonneville, or Western, or any of the other administrations, could be employed to help restring wire on transmission lines. We also assessed whether any of the back-up and spare equipment we keep at DOE facilities could be employed in any way.

That is a new approach that we're taking to energy emergencies. We're now just completing what we call the "lessons learned" from this to see what we can institutionalize, where we can improve, what we can do in the future for similar types of natural disasters.

ADDITIONAL RESOURCE REQUIREMENTS

Mr. DICKS. Are there additional requirements, either in personnel or in contracting areas, that you see as being necessary for you to respond properly to energy emergency situations?

Mr. EASTON. I think it would be premature to say, "yes." I guess every Federal bureaucrat would like to say, "Yes, Mr. Chairman, it'll take some more money." I think it would be premature to say that until we have completed this lessons learned report that I have just mentioned to you, until we have looked at what we did learn, and until we have looked at whether we require a reorganization of any type, as well as whether we require additional contractual money or people money. If we did, we would come back in a future budget cycle to request that. At the moment, we think our resources are adequate.

Mr. DICKS. Would you give us a copy of that report when it is done?

Mr. EASTON. We'd be happy to.

[The information follows:]

LESSONS LEARNED FROM RECENT ENERGY EMERGENCIES

DOE is currently engaged in a comprehensive natural disaster after action assessment which focuses on energy and whose scope includes Hurricane Hugo, the Lome Prieta earthquake, ice storms and severe thunderstorms. The report is expected to be completed in April 1990 and is addressing lessons learned from the standpoint of:

(1) Identifying appropriate organizational roles and responsibilities for energy supply emergency preparedness and response/restoration for major natural disasters;

(2) Improving energy supply emergency preparedness; and

(3) Improving energy supply response/restoration when major disasters occur.

In view of the Committee's request for lessons learned information, the project staff is providing these tentative conclusions:

From an organizational role and responsibility point of view, DOE must be prepared to respond appropriately, and to facilitate energy related preparedness and response with States, other Federal agencies, utilities, industry, contractors, manufacturers and DOE elements.

Many actions may be appropriate, by DOE and others, to achieve adequate energy supply preparedness and response to natural disasters. Some of the major areas for possible preparedness improvements are:

- The "Federal Plan for Response to a Catastrophic Earthquake or other Catastrophic Natural Disasters" should be modified to include a new emergency support function for energy. Planning for this has been initiated by the Federal Emergency Management Agency and DOE.

- Preparedness planning should encompass the entire spectrum of natural disasters.

- Service restoration priorities for electric, gas and telecommunications utilities should be adjusted to include, in addition to essential civilian needs, national security priorities, and energy and telecommunications system interdependencies.

- DOE should plan and implement procedures to permit deployment of energy experts to the field on short notice.

- A data base of key spare equipment is desirable. For example, sources of emergency generators should be known to permit rapid deployment in emergencies.

- Energy and telecommunications utilities should consider installing a "hot line" to coordinate restoration efforts.

- Procedures for obtaining Jones Act waivers need to be refined to expedite the process which permits foreign-flag tankers to assist in transporting fuel oil and propane to the northeastern U.S. or other U.S. destinations during an incipient fuel supply emergency.

- A forum wherein petroleum industry members could meet in conjunction with other energy sector representatives and federal/state officials during a supply emergency to coordinate an appropriate response (without undue fear of antitrust actions) could be very helpful in resolving regional supply imbalances.

- Developing a rapport with the U.S. Coast Guard and the cooperation of "Port Captains" is essential in arranging expedited passage of critical refinery feedstocks or heating fuels through congested ports.

Major areas for response/restoration improvement are:

- Federal agencies posting personnel in impacted areas should recycle personnel, not rotate personnel, in order to preserve institutional memory.

- Adequate and continuous monitoring and recording of local and network radio and television broadcasts is needed for early identification of issues that will confront policy makers.

- Energy suppliers must have fast, open communications with the media to avoid dissemination of erroneous information that may prolong restoration.

- In the event of power outages lasting longer than three days, telecommunication utilities will need refueling for their emergency generators.

A number of actions apply particularly to response/recovery in offshore areas. For example:

- Engineers and line crew management should be deployed quickly.

- Prototype Agreements and Protocols for repair contracts should be prepared in advance of an emergency.

- When disasters occur in offshore areas, requiring two-way air transport of utility and contract repair crews and their equipment, it is important to use air transport efficiently by recruiting utilities large enough to leave their equipment on site indefinitely and to rotate their crews.

- The Regional Security System (RSS), an organization of seven Caribbean countries, should be used to assist restoration efforts when appropriate. The RSS can expedite material and equipment deliveries, expedite Customs clearances and prevent theft.

RECENT HEATING OIL INCREASES

Mr. DICKS. All right. Do we have the Administrator of the Energy Information Administration here?

Mr. EASTON. He is——

Mr. DICKS. Why don't we have him come up here? We're going to get into the heating oil thing, and we understand he was involved in that.

In December 1989, propane and heating oil prices increased substantially and supplies were also short. Please describe DOE's role in this situation. I'm going to hold here a second.

We're going to turn the chair over to Mr. Atkins, who is an expert on this area. [Laughter.]

Mr. EASTON. Mr. Chairman, as you're getting situated, I'll introduce, for the record, my colleague, Dr. Helmut Merklein, the Administrator of the Energy Information Administration, and just open by saying that the Office of Energy Emergencies, one of my offices, and Dr. Merklein's Energy Information Administration, worked hand in glove during December and January to analyze what took place during the tight supplies of December and the runup in prices that occurred in late December and early January. It was, I think, through the capability of the Energy Information Administration that we have a much greater understanding today and will know more in the future of just what did take place in December and January.

Mr. ATKINS [acting chairman]. Go ahead. Do you want me to repeat the question?

Dr. MERKLEIN. No. I remember what the question was.

Mr. ATKINS. Okay.

Dr. MERKLEIN. I've dealt with it enough.

Mr. ATKINS. You've answered it a few times before?

Dr. MERKLEIN. Yes, sir.

What happened, of course, was that out of the blue sky in mid-December temperatures dropped precipitously, and we had the coldest December in 60 years, particularly on the East Coast. That brought on, of course, probably the steepest increase in demand in about 60 years for heating fuels in distillate, particularly on the East Coast. The system was not geared for this extraordinary demand on it.

We had reductions in inventories at the time in distillate, something approaching the order of a million barrels per day. We were running into inventories, and when inventories became low, prices shot up. This hurt an awful lot of people.

I just want to say for the record that in the area of heating oil prices, they have returned to normal. By normal, I mean that they have returned to about 10 or 12 cents above what they were last year. Of course, the crude oil price has also risen roughly the equivalent of 10 to 12 cents per gallon this year over last year.

In the heating oil arena, both in the wholesale markets and in the retail markets, the price rise was short-lived. To me, a measure of the competitive structure of the market was the speed with which heating oil prices did return to normal.

Inventories and heating oil are above normal now. There is no apprehension on anyone's mind, at least within our department, the Energy Information Administration, concerning the adequacy of inventories for the rest of the year.

On propane, it was a little bit different. Propane problems arose mostly in the Midwest, PADD II, but to some extent, also in some of the PADD I, the Atlantic Coast States. Propane prices rose very precipitously, both wholesale and retail, and returned rather quickly at the wholesale level, but have not yet quite returned to normal on the retail level. I would say an off-hand, blanket, across-the-board statement would be that they have returned roughly about two-thirds to normal. They have about one-third of the way to go.

I'm sure you'll want to go into the question of how prepared we were.

Mr. ATKINS. Get yourself comfortable in the chair.

Dr. MERKLEIN. All right.

CURRENT HEATING OIL PRICES

Mr. ATKINS. Let me just be clear in terms of your position on the price. You're saying that the price now is 10 to 12 cents above what it was previously.

Dr. MERKLEIN. In distillate.

Mr. ATKINS. In distillate, but that the wholesale price——

Dr. MERKLEIN. Is also back to normal.

Mr. ATKINS. The cost per gallon is 10 to 12 cents above what it was previously.

Dr. MERKLEIN. Correct. Yes, sir.

Mr. ATKINS. However, that increase—are you comparing the wholesale price now and then, or the barrel price?

Dr. MERKLEIN. You can do it two ways. You can take the beginning of December, for example, retail and wholesale prices in distillate, and compare it with the beginning of December retail and wholesale price the last season as compared to the current season, and then they come about 10 cents above. That relates to crude oil on a one-to-one basis, more or less.

You could also do it with today's prices. Since the prices have returned to normal, both at the wholesale and retail level, and you will again, as of today, find that retail and wholesale prices in distillate are back to normal. Again, I define this as about 10 cents above last year's prices.

Mr. ATKINS. So you're saying that the spread between retail and wholesale is the same today as it was a year ago?

Dr. MERKLEIN. I would, just off the top of my head, say it is about right.

HEATING FUEL MARKET BEHAVIOR STUDY

Mr. ATKINS. Could you tell me the results of the short-term study that you undertook in terms of your short-term analysis of heating fuel market behavior?

Dr. MERKLEIN. On heating fuel, that is on distillate, I have right now, a few reservations regarding the competitive structure of the market. I am saying this knowing that the final profit data are still not in, but the fourth quarter profit data are in for the major oil companies, for example. In the marketing arena, the profits are down from the fourth quarter of the year before.

Again, they don't run half a month's profits. All this perturbation occurred in the second half of December. So, again, I hold out the possibility of surprises, but they would be rather dramatic surprises, frankly, concerning their profit statements on the first quarter of this year, which are due 45 days after the end of April.

Mr. ATKINS. So on your view in terms of the market structure, you said you have few reservations. What are those reservations?

Dr. MERKLEIN. I have no reservations.

Mr. ATKINS. You have no reservations?

Dr. MERKLEIN. Not in distillate, no, sir.

Mr. ATKINS. So in distillate, you believe that it was just the cold weather and not any price gouging that was the cause for the huge price increases?

Dr. MERKLEIN. Well, price gouging is another definition, but I think what you mean is collusive behavior and a sense of companies getting together and conspiring to drive prices up through agreements, verbal or otherwise. I'm convinced that did not take place.

Mr. ATKINS. How about companies spontaneously decided to drive the prices up without getting together?

Dr. MERKLEIN. Well, there has been testimony and, of course, I was privileged to listen to it, by, for example, Star Enterprises, the Ramco-Texaco joint venture on refining and marketing in this country, where they pointed out that to a considerable extent, to the extent that they themselves had to meet demands vastly exceeding their own planning levels, they had to enter this market themselves and saw their costs eroded.

Their testimony was, and I'm sure they were prepared to back that up, that for this particular interval they had no particular increase in profits. I could believe that the statement was correct. In any event, I saw after the crisis, inventories being built up very rapidly. Both at the wholesale level and at the retail level, prices were dropping very rapidly in distillate.

So one might have argued that even if there is no overt collusion, if people had had the market power to hold on to the high prices now that had been driven up for them by events extraneous to their decision-making process, they might have used it, but they didn't have the power, and the prices came down. I'm sure, of course, it is in the nature of companies to charge as much as the situation permits. They just didn't have that power.

HEATING FUEL INVENTORY LEVELS

Mr. ATKINS. Can you tell me what normal inventory levels are going into a heating season now compared to past years?

Dr. MERKLEIN. Much has been made, and I can testify now, just from the top of my memory. Of the inventory levels, they happen to be just a little bit below, at the beginning of this season, compared to the beginning of the season before that, but they were not low in regard to other seasons preceding these two years.

It is easy to say in hindsight, having had the coldest winter in 60 years, that clearly the inventories were inadequate. That was impossible to determine beforehand. We, ourselves, had no apprehension. We had pointed out lower-than-previous-year inventory levels but not in any alarming way.

Mr. **Atkins**. Did those levels increase the potential of a shortage or price run-up?

Dr. **Merklein**. Well, yes, of course. In retrospect, they did.

Mr. **Atkins**. How significantly?

Dr. **Merklein**. Oh, that's very difficult to quantify. Certainly off the top of my head I wouldn't be able to do it. There is a confluence of all kinds of events. For example, you had market differentials from that second layer of inventories that the industry has come to rely on, which is the Rotterdam markets. Those market differentials moved way in a direction opposite, or not conducive to, the movement of distillate from Rotterdam into the United States. In other words, contrary to historical events, at this point in time, a distillate was more expensive in Europe than it was in the United States. For that reason, it required a very substantial increase in prices to dislodge it and make it come to this country, which eventually it did and with a vengeance.

Mr. **Atkins**. So how would you characterize, for the record, the role of inventory levels as a factor contributing to the price run-up?

Dr. **Merklein**. Well, it was a contributory factor.

Mr. **Atkins**. How significant a contributor?

Dr. **Merklein**. Well, it was significant, yes, very significant.

Mr. **Atkins**. Can you ascribe a percentage range to it?

Dr. **Merklein**. I would hate to do that.

Mr. **Atkins**. Well, would you do it? [Laughter.]

Dr. **Merklein**. All right. You forced me into it. Somewhere between 10 and 90 percent.

Mr. **Atkins**. Between 10 and 90 percent?

Dr. **Merklein**. Yes, sir. [Laughter.]

It was significant. There's no two ways about it.

Mr. **Atkins**. More than half or less than half?

Dr. **Merklein**. All right. We'll make it 50 percent. I just don't know.

Mr. **Atkins**. Do you expect to have that in your final report?

Dr. **Merklein**. We'll try to come to grips with it. This is going to be a very difficult question, but we will try to come to grips with it. I promise you that.

Mr. **Atkins**. When you say, "try to come to grips with it," you'll try to give us some indication in the final report of a——

Dr. **Merklein**. Of a percentage causation by inventory levels.

[The information follows:]

IMPACT OF INVENTORY LEVEL ON PRICE RISE DURING DECEMBER'S HOME HEATING OIL CRISIS

Prior to the commencement of the cold snap in December, inventory levels were not a significant factor in heating oil prices. At the beginning of the 1989/90 heating season (October 1989), residential heating oil prices exceeded year-earlier levels by about $0.10 per gallon. This was roughly equivalent to the $0.12 per gallon price increase of crude oil over the period October 1988 to October 1989. At the end of October 1989, U.S. primary distillate inventories stood at approximately 121 million barrels (MMB). While this was 7 MMB lower than the previous year's level, it was the same level as two years earlier.

The onset of severely cold weather in December resulted in the largest one-month increase in national distillate demand in at least a decade, to a level of 4.1 million barrels per day (MMBD). As much as 25 percent of the unanticipated demand (about 150 thousand barrels per day or MBD) stemmed from large, traditional natural gas customers interrupted in favor of higher priority gas accounts and having to buy distillate and other petroleum fuels.

The $0.19 increase in the spot price of heating oil in the first half of December was in response to this surge in demand coupled with problems in the distribution system, due largely to the weather, in getting available supply to the customer when needed and in the amount desired. At the same time, U.S. distillate production increased 150 MBD over the first two weeks of December and stocks dropped 6 MMB from about 122 MMB to 116 MMB. That was still well above the National Petroleum Council's minimum operating inventory level of 85 MMB.

The price spike of $0.22 (spot price New York Harbor) in late December coincided with the news of shutdowns and cutbacks at 13 refineries, representing 20 percent of national distillate production. The biggest refinery affected was Exxon's Baton Rouge facility. There was widespread concern in the market that the supply system would be incapable of meeting demand.

As it turned out, these apprehensions were unwarranted. The impact of refinery shutdowns on production levels was offset in large part by higher utilization rates. As a result, while stock levels at the end of the month were about 107 MMB, down 9 MMB during the last two weeks of the year, this drawdown rate was less than might have been expected given record demand levels. In fact, December weekly peak demand of 4.4 MMBD (week of December 22) saw peak inventory draw-downs of 670 MBD. At that rate, the inventory cushion above the minimum operating level was sufficient in size to last another 33 days.

In summary, inventories should not be viewed in isolation; rather they constitute just one factor in total product available for supply, including production and imports. This forward supply then weighs against apparent demand in determining the impact on price. In modelling and forecasting, the Energy Information Administration has found that inventories alone do not sufficiently explain price behavior, and forecasts for heating oil prices are derived primarily from world oil price projections and local demand measures such as heating degree days.

STATE HEATING OIL PROGRAM

Mr. ATKINS. Let me ask you, do you feel that there were adequate data on heating oil prices and supplies available under our current State heating oil program?

Dr. MERKLEIN. Oh, I believe so. We have had a few complaints, as you're well aware, but mostly in the area of propane, not so much in heating oil. We are pretty well on top of the heating oil situation.

We do run, as you know, a cooperative program with the States in heating oil. It is not quite as extensive as it used to be, in part because some funding had been cut off. That was about $200,000 a year. That amounted to about $16,000 per participating State. That is roughly a little less than half the price of a fair-sized snowplow in this country. Nevertheless, about three or so States had dropped out because of that $16,000, including Massachusetts for the record.

Perhaps some of the States that had dropped out felt shortchanged. They just didn't have the data available. Those States that we had continued to work with, and we had promised this committee and other committees we would continue to work with all States, and volunteering to stay on the program——

Mr. ATKINS. You have how many States right now?

Dr. MERKLEIN. 13.

Mr. ATKINS. Is it 13 or 11?

Dr. MERKLEIN. It is 11 now.

Mr. ATKINS. It is 11 now.

Dr. MERKLEIN. Okay.

Mr. ATKINS. So you rely for the emergency and voluntary submission of information from 11 States. It is my understanding that for the most part those States are collecting only monthly residential retail prices. Is that correct?

Dr. **Merklein**. When we get into the details of these questions, I'd like to get permission to get——

Mr. **Atkins**. I would be delighted. Do you have someone else? Why don't you come up to the table. If you could identify yourself?

Dr. **Cook**. My name is John Cook. I'm the Director of Petroleum Marketing Division. I run this program that you're discussing.

Over half of the 11 remaining States in the heating oil program are typically left to their own. Programs would collect only monthly residential heating oil prices. However, this year, in organizing the program, we were successful in coaxing everyone to agree to do them twice a month. Still some were slow to do that until the cold weather beset us, and then everyone could see the need to do them even possibly weekly. It is kind of a flexible situation.

Mr. **Atkins**. As I understand it, EIA assumed a level of supply in a given State based on a regional number and there wasn't a correlation between those figures, or those figures did not represent the reality, and that the data are not compatible State by State, they're not comprehensive? Is that correct or not?

Dr. **Cook**. Partly so.

Mr. **Atkins**. What portion is correct?

Dr. **Cook**. I would say that because not all of the States collect stocks data, we were forced to, in this program, take the monthly State stock information that we normally collect as part of our program and then move those monthly State estimates forward using regional numbers from our weekly collections. So they were estimates that we thought were reasonably accurate.

PROPANE SUPPLY AND PRICE MONITORING

Mr. **Atkins**. Now do you have any ability to monitor propane supply and price?

Dr. **Cook**. We did both. Because of the extreme circumstances, we quickly prepared a clearance package for OMB to put into place a propane stock survey this past season, and we likewise selected a sample of propane retailers and surveyed them on a twice-a-month basis also. This program, of course, could be structured in such a way as to do that also.

Mr. **Atkins**. So you're telling me that you did or did not have the ability to monitor propane supply and price?

Dr. **Cook**. Well, yes and no, not in a bi-weekly or twice-a-month manner at the outset of the season. We do monitor both of those things on a monthly basis always.

Mr. **Atkins**. I'm just curious——

Dr. **Merklein**. Let me add something. What we did not have, like we did in this plan, is a cooperative program in propane. Certainly, of course, the kinds of fuels that were covered in our stand-by collection system were agreed upon originally in discussions with States, and even the States had not seen any need at the time until December of last year for this kind of data collection.

So yes, when December came rolling around and we had this extraordinary cold wave, we did not have, on an almost real-time reporting basis, data on propane the way we had them on distillate.

As Dr. Cook has indicated we immediately jumped into it and started a collection program, which is now underway, and we are discussing with the States means of introducing this on a permanent basis, very much like the distillate program on a State coop-type program.

Now the States themselves very much want to collect the data themselves and pass them on to us for reasons all their own, enforcement or what, probably, among others. So that is why the States are favoring this joint approach. Otherwise, we would do the collecting and just report it out, but the States feel they need additional detail. We're working on both now—distillate and propane, and Dr. Cook will give you some details on just what we envision, and what the States envision, and where we differ, and where we are together. In most places we are together.

We'll take it from there if you like.

Mr. Atkins. You testified before the Energy and Power Subcommittee of the House.

Dr. Merklein. Yes, sir. I remember it well.

Mr. Atkins. And it was my understanding from that—and correct me if I'm wrong—that you gave an indication that EIA had no ability to monitor——

Dr. Merklein. Well, on the instant turnaround-type of information that they wanted because they had all the heating oil information, with about a 7-day or so lag, and they had propane information with about a 60-day lag. In the midst of the crisis, that clearly wasn't good enough, so that was a complaint, and that was my concession. Yes, we do not have instantly-available propane data. We are correcting that. Again, we have a program on hand now, even in this season, and we'll have it flexed out even more for the coming season where propane and distillate will be dealt with on a joint program very much like distillate always has been.

Mr. Atkins. How will that be funded?

Dr. Merklein. Well, there are two levels of funding. Within EIA, we just absorb it into our cost structure. I think what you're driving at is the grant program that the States are requesting, and I understand we got a copy of a letter signed by 43 Members of Congress to Mr. Yates requesting that a grant program be provided to the States, in, I believe, the amount of $450,000.

My view on this simply has been—well, there are two points that I want to raise with this. Number one, whether the money is granted or not, there is no substantial disagreement as to whether we would continue to do it at the level at which the States, by and large, will be satisfied. So the grant program does not buy into this. The grant program only answers the question whether the States will have supplemental monies. Again, I remind you this is about half the price of a snowplow in those parts of the world, to put a person on a payroll to make the necessary inquiries.

We have resisted that to some extent, although in the final analysis, to some extent, to Mr. Yates' and your call, simply because that is the cost of doing business in the New England States. I had a problem seeing Federal funds allocated to this sort of a problem because what this would mean is that the people in Arizona would participate in the payment of snow problems in New England.

Mr. Atkins. But don't people in New England participate in paying for resource protection, and cotton programs, and problems with water distribution in Arizona?

Dr. Merklein. That's true.

Mr. Atkins. Isn't that why we have a Federal Government?

Dr. Merklein. I would argue with you that, while this is true, one might question whether that is a reasonable proliferation of these kinds of programs. In any event, on the substance of the program, as far as we are concerned, the $450,000 doesn't make much of a difference. We will do the same programs.

TIMELINESS OF REPORTS

Mr. Atkins. But are you telling me that you'll be doing bi-weekly reports throughout the heating oil season? That you're prepared to do that now?

Dr. Merklein. We are prepared to do the following. Dr. Cook can elaborate in some detail. Of course, we will keep track of inventories. We propose to have an early meeting, like in September, where we get all the State officials together, and industry officials, and, of course, Federal Government officials, to discuss the inventory situation so that everybody is apprised as to what happens. We would run the heating oil and propane program, as we always have, monthly, if pushed, bi-weekly. That is feasible.

The important point is, monthly or bi-weekly, that the system is in place, and the contacts exist, and we would know whom to call so if we have to ramp up this thing in the case of an emergency, we know who the players are.

Mr. Atkins. That'll be too late to—I mean——

Dr. Merklein. It was too late last December. That was the problem in propane. In heating oil, we——

Mr. Atkins. There was a problem with distillate, too.

Dr. Merklein. Not really. We knew the players. We could make calls. We could apprise the situation very quickly.

Mr. Atkins. But you weren't able to raise the alarm call about inventories which you claimed—you said under some duress, probably accounted for 50 percent of the price run-up.

Dr. Merklein. That was, of course, a 20/20 hindsight call. Yes, in retrospect there was a shortage. There weren't sufficient inventories. Could anyone have guessed? Did the State officials guess? Did the corporations guess? Did the Federal Government guess in September that they would be inadequate? The answer is, reasonably, they did not.

Mr. Atkins. But will you be able to give us for next year what you feel is an adequate level to provide protection for people against that kind of price run-up and be able to monitor that?

Dr. Merklein. That depends on the level of detail to which you are talking about.

Mr. Atkins. At a sufficient level of detail so that we don't face the increase.

Dr. Merklein. Okay. All right. I'll take a quick shot at it, and then Dr. Cook will provide details. On a primary level, yes, we have no problem. Secondary inventories will be a problem. There are, among other things, 25,000 dealers out there that we would have to keep track of on a week-by-week basis, and this would be very, very expensive. $450,000 would not even begin to touch it. Dr. Cook may address some of the details on that.

Dr. COOK. Okay. We adequately monitored the price and supplies of heating oil last year. Even up through, as the report indicates, the end of November no one, either in the State level, the Federal level, or in the industry, saw that there was a problem. The inventories were low but not any lower than they were several years ago. With all the above-normal weather—it is getting pretty late in the year if you haven't had cold weather by December. No one really saw a problem at that point.

Propane was a different story. We did not have propane in stock, so our price stayed up. What we're proposing to do is monitor propane the same way that we do heating oil for next year. We will get together with the States that are interested in participating in the May/summer timeframe to pull all those States into the program that wish to join, so that we can survey those prices and stocks.

ASSISTANCE TO STATE PROGRAMS

Mr. ATKINS. At this point, though, you have nothing to offer the States in terms of——

Dr. COOK. Well, certainly we do. We have a lot of statistical expertise to draw the samples, prepare the estimation methodology, and collect the data from them. Essentially, all they would do is make the phone calls. Then they would send the results of the phone calls to us for aggregating and disseminating.

Mr. ATKINS. What is your estimate of the cost to the States of doing that? Typically, let's say, Massachusetts, just to randomly pick one State.

Dr. COOK. Let's do it another way. The average grant cost the last time there were grants for just heating oil was $13,000.

Mr. ATKINS. Yes.

Dr. COOK. So if you added another product like propane with just as many telephone calls to make—they are not overlapping telephone calls—$20,000 was our estimate per State.

Mr. ATKINS. Why shouldn't the Federal Government be providing the States the resources to do that?

Dr. COOK. Well, it's our position that this is a State program, and that they should supply those resources and make the phone calls. We'll supply the expertise to produce the estimates.

Mr. ATKINS. Is it fair to say that this is part of the Administration's policy of "read my lips, raise your taxes," to the States? You don't need to answer that.

Dr. MERKLEIN. Thank you.

Mr. ATKINS. You're welcome. [Laughter.]

REGIONAL PETROLEUM RESERVES

Let me ask you one final area. Congressman Conte has suggested establishment of a regional petroleum products reserve, so essentially we'd have inventory to deal with extreme weather. Could you give me an indication of your thoughts on that?

Mr. **Easton**. I'd be happy to. I guess that falls in the policy area, and my colleagues are the people that give us the data and the information so that we can then determine what the Department's policy should be.

Mr. **Atkins**. Let me just thank Dr. Merklein and Dr. Cook for their equanimity in responding to the questions. I know your job this past winter has not been easy, and I appreciate the difficulties that you have labored under, notwithstanding our disagreements as to who should pay for the program in the future.

Dr. **Merklein**. It's appreciated. Thank you.

Mr. **Easton**. We have looked at the issue that your colleague, Mr. Conte, has raised on a number of occasions in the past. In the past, we at the Department have not felt that a regional product reserve was warranted because of some concerns that we simply didn't have answers for. These concerns are such things as what product do you store, how do you determine what product you need to keep, how do you determine what levels need to be kept, where should these be located, how do you turn over products, unlike the Strategic Petroleum Reserve where we can put the oil in the salt domes and basically forget about it. The products have to be rotated, and that raises issues similar to the issues we dealt with on selling Strategic Petroleum Reserve oil come to play when you talk about, well, how do we sell these products and to whom, at what price, and so forth.

That has been our historical perspective on regional product reserves. We think that a refinery, for example, would give much more flexibility to our region than product reserves. On the other hand, you can't go through a winter such as we went through where we were very short without having to retest and reexamine some of our underlying premises. We're doing that right now. My colleague, Mr. Caruso, met last week with representatives of the New England Governors where this issue came up. What we have been doing is saying to all of those who called on us to do this is,"Help us answer some of these questions that we have traditionally raised," such as what product, what levels, who is going to pay for it, where do you put them, and how do you turn them over? We are reassessing this. We have told the States, "The more information you can provide us, the better job we'll do in trying to come up with the right policy."

Mr. **Atkins**. When do you expect to have an answer on that?

Mr. **Easton**. We're looking at it, Mr. Chairman, in context with the National Energy Strategy, on which the interim report is due for release next month, and then we have the timetable between now and the rest of the year to start finalizing the issues raised in the interim report. We would hope certainly by the end of this year to come to some conclusions as to whether we stand by our previous position on product reserves or whether we've seen some guidance that directs us another way.

Mr. **Atkins**. My concern, and I think the concern of many of my colleagues, is having a similar situation next year. I can't begin to describe to you the economic hardship that this imposed, particularly on people on fixed incomes, low-income people, the elderly—this was just a terrible crisis for them. Indeed, for many people it posed a direct health threat and a threat to public safety. I think many of us would like to be able to assure our constituents, as we go into the heating season next year, that as a Government we have done everything that is prudent to try to assure, without undermining the concept of free markets, to protect them from a similar kind of price run-up.

What I fear is that your report will be available in the middle of the heating season and that we won't have been able to have taken the actions that were appropriate to try to protect people prior to the heating season.

Mr. EASTON. The problem is that even if we said today, if I answered your question and said, "We have been persuaded by all the calls for a regional product reserve, that we will set up seven of these, and they will be done immediately," I'm not so sure that those would be in place by the next heating season. There is a question of finding the capacity, perhaps building it, where it is to be built, and going through environmental impact statements.

Even if we were to decide that this is a great idea, that Mr. Conte's legislation is not needed, we're not going to have those in place by the next heating season. That's not to say that we can't take some steps to figure out if there is more that my Office of Energy Emergencies should be doing. I think I'd look pretty ridiculous if we go through another situation, and I'm here saying, "Well, I told you last year was the coldest December this century, and it's only a one-in-a-century occurrence," and then I'm back up here trying to explain why it happened a second year in a row. I assure you that I don't want to be back here trying to answer those questions.

We are looking at what do we do in between saying that we need to go back to the days of controlling prices and allocation, between that extreme and the extreme of saying, "Forget it folks; this was the coldest December on record, and we don't need to do anything because the weather will be normal next year." We think there is some middle ground. We're looking at issues that would tell us what are the responsible activities that the Federal Government should take, in partnership with the States, in between those two extremes of intruding in the marketplace and saying that the marketplace works fine, and we don't need to do anything. We think there is some middle ground.

CONTINUING EMERGENCY PREPAREDNESS ACTIVITIES

One of the steps we will be taking, for example, is my office will be convening all the people, twice a year now, starting with a conference about a month from now and then another one in the fall in advance of the heating season, to look at what the predictions are for the season ahead, for example, getting weather people, and getting economists. What is the economy going to do? Are we going to be having a recession, or are we going to be dealing with lots of demands for energy products? We'll be testing some of our assumptions and looking at some of the environmental proposals that are coming up.

For example, a year ago, the new Reid vapor pressure standards caused some temporary dislocation in gasoline supplies. We'll be hosting conferences to look at all of these issues to make sure we in the Federal Government are better prepared in advance of these seasons.

Mr. ATKINS. Tell me, when do you expect to have that ready for us?

Mr. EASTON. We are going to convene, twice a year from now on, conferences so that we can get all the Federal and State and industry officials together to look at what is coming up during the summer driving and summer air-conditioning season and the winter heating season. This will be an ongoing process where my Office of Energy Emergencies will be taking even a greater role than we have had in the past.

NEED FOR ADDITIONAL RESOURCES

Mr. ATKINS. Will it be possible for you to provide for this committee your full list of recommendations prior to our markup, which would be prior to June 1, your recommendations for any matters that would be under the jurisdiction of this Committee in terms of resources the EIA would need, or any other things that would be necessary to deal with an emergency next year?

Mr. EASTON. I suspect we will have some answers before markup. On other issues, such as the regional product reserve, we probably will not have answers. We will have some answers as to what changes we feel we should take as an Office of Energy Emergencies, or what Dr. Merklein's Administration might need in terms of new data-keeping——

Mr. ATKINS. Presumably some of that is going to cost money.

Mr. EASTON. That's right.

Mr. ATKINS. And you have not provided that to the Subcommittee in the budget that you have submitted to us. Is that correct?

Mr. EASTON. Earlier, in answering a question about our involvement in non-heating emergencies, the natural disasters of Hurricane Hugo and the earthquake, I said that we are compiling from those two natural disaster-type situations, what our role should be. Our role was much more involved and a hands-on effort. Once we find the lessons learned from that, I said that we'd be coming back in the next budget cycle if we felt that it required additional resources. We feel our resources right now are adequate to do the job as we have been doing it with the slight change that we have taken in terms of more involvement.

Mr. ATKINS. So you don't feel that you need any changes to this year's budget?

Mr. EASTON. Not on the basis of what we know now. We think, for example, the hands-on involvement we had with the natural disasters we can do under our existing budget. What I said is that if we find in some of our analyses that we think we need to reorganize, to have more contractual dollars for studies or more people, we would put that into the next budget cycle as part of the normal budgetary process.

Mr. ATKINS. I'd like assurance for this budget cycle. That's the one that I focused on. We should have something from you in writing indicating that if the budget levels, as submitted by the President, are passed by the Congress, you feel that you have the resources and the powers to do whatever you know presently needs to be done to have a positive impact on either a natural disaster, to do what the Government needs to do, or in a price run-up in petroleum or distillate.

Mr. **Easton**. I don't want to leave a misimpression, Mr. Chairman, about price run-ups. Price run-ups are part of the way the market system works to assure that the product gets to the area that it should get to. So I'm not so sure that you're going to receive from me something that would say, "You'll never see a price run-up."

Mr. **Atkins**. What I am suggesting is something from you that says that you have the resources to do whatever the Government is able to do to mitigate the impact of a price run-up.

Mr. **Easton**. That is a fair——

Mr. **Atkins**. When might you be able to have that for the Committee?

Mr. **Easton**. If we have any recommendations that change the way we do things, we will try to have it to you before your June markup.

Mr. **Atkins**. Okay. You will have a letter, though, indicating that you have the authority and the resources that you need to respond to future emergencies——

Mr. **Easton**. That is correct.

[The information follows:]

Department's Ability to Respond to Future Emergencies

As part of our review of "lessons learned" from the Federal responses to the recent energy emergencies, we will be assessing the adequacy of our current resources to respond to future energy crises. One of the factors to be assessed is what can be done, within the market-oriented response policy of this Administration, to minimize the effects of the emergency on the public. The answer to this question will determine, in part, the need for additional personnel or financial resources.

IMPACT OF RISE IN HEATING OIL PRICES

Mr. **Easton**. Let me say that one of the big authorities here to prevent the sort of problem that you're concerned with, and I think that we're all concerned with, is the effect of price run-ups on those who can least afford it—the elderly, those who are on fixed incomes, the poor, the people that simply do not have the wherewithal. There are both State and Federal programs for financial assistance, which do not come under our Department, so——

Mr. **Atkins**. I appreciate that. Of course, I'm looking to mitigate the effect of the run-up itself. I mean, for the family that's got four kids, with earnings slightly above the minimum wage, this thing is as devastating as it is for the elderly person who is living on social security. Even though that person may not be eligible for LIHEAP assistance, for instance, I'm just looking to mitigate the run-up itself, the price impacts. I'm not asking you to get in and help them and service this program.

Do you feel that the Department was able to affect, in any way, the run-ups of last winter and mitigate them?

Mr. **Easton**. I think where we had an impact was not necessarily as much in the price area as in the supply area. I think the Department was very effective in assuring that people did not go without necessary heating fuels during that coldest December of this century.

We assisted, for example, in the expeditious processing of Jones Act waivers to allow for foreign flag carriers to bring propane into New England. We assisted in the relaxation of the driver hour limitations so that drivers could work the extra hours and get the product delivered to the customers. We worked to assure that railcars and tankcars were available. I think the Department of Energy served as a catalyst and a cutter of red tape by working with our sister agencies in the Federal Government to make sure that the product got to where it was needed.

We were probably less successful in keeping a lid on prices. As I say, part of the success of getting product to where it was needed, getting product into this country rather than going to Europe, was because all of a sudden the prices were such that it attracted products from overseas.

JONES ACT WAIVERS

Mr. ATKINS. Could you explain what impediments existed because of the so-called Jones Act relative to use of foreign tankers?

Mr. EASTON. One of the problems, and I think that will be where you ask us what have we done, and what will we be doing to change things, is we are working currently with both the Maritime Administration, the Defense Department, the Treasury, and the Customs Service that grants the waivers to have a memorandum of understanding as to how these will be processed and the timeliness of processing.

I think that one of our concerns at the Department of Energy was that when we're looking at the availability of a foreign flag vessel versus the availability of a U.S. flag vessel, availability might be looked at very differently from our agency versus another agency. What we are trying to do is take action through a memorandum of cooperation with the other agencies so that we are defining what our respective roles are to make sure that these decisions, whether they're favorable or unfavorable, are granted on a very quick basis so that the shippers then know whether they can rely on a foreign flag vessel.

Mr. ATKINS. Has the U.S. Maritime Administration modified their position in waivers to the act?

Mr. EASTON. They are working with us in this memorandum of cooperation, and I think we are fairly close to some agreement. Within the next month or so, we may be able to tie the knot on this thing, so we're all on the same wave length about what our respective roles are.

Mr. ATKINS. Is the Administration considering submitting legislation to change the provisions to cover emergencies?

Mr. EASTON. There is a provision now as part of the oil spill bill that—and I'm not sure in the last week or so where it stands—did touch on Jones Act waivers. Our concern, as we saw it, was that it might actually make it tougher to obtain Jones Act waivers. We have been working with the Merchant Marine Committee to make sure that nothing is done that makes it more difficult to get these waivers.

Mr. ATKINS. But you don't plan to submit any legislation?

Mr. EASTON. No. Since there is a vehicle now, if we can work with that vehicle and keep everything as is, we think it will work.

LEGAL ACTION RESULTING FROM HEATING OIL CRISIS

Mr. ATKINS. Is the Justice Department still considering action with regard to price increases that occurred during the run-up last December and January?

Mr. EASTON. As far as I know, and I haven't had any formal communication from the Assistant Attorney General for Antitrust, they are still reviewing the information that they have been receiving and compiling to determine whether there is any jurisdiction of the Justice Department.

Mr. ATKINS. Can you tell me if you uncovered any problems outside of the Maritime Administration, things that were spoken about during the period of the price run-up, anything that you think ought to be changed with regard to Government laws or regulations as they affect emergency situations?

Mr. EASTON. I think our primary focus early on was Jones Act, and after that, the issues that we dealt with all seemed to have been handled just through interagency cooperation and without the necessity of any legislation, so I don't think that we will have any required new legislation.

Mr. ATKINS. Can you tell me what kind of reaction you got from industry with regard to your intervention?

Mr. EASTON. I think it was generally very favorable. When we called Federal officials and State officials in the industry together, we did so on Saturday, the 23rd of December, as most people were starting their Christmas holiday weekend. Yet we had pipeline officials, refinery executives, fly into Washington, give up their Saturday afternoon to come and hear from State officials, hear first hand what the problems were, describe to us what they were doing to meet them, and I think it was a very favorable response.

Mr. ATKINS. Thank you very much. I have some further questions for Dr. Merklein.

Mr. EASTON. Thank you.

[Questions and answers for the record follow:]

ADDITIONAL COMMITTEE QUESTIONS

Strategic Petroleum Reserve

Question: The sizing study shows that in most cases even going from 600 million barrels to 750 million is not economic, based on cost-benefit analysis. What other factors were considered, since the final recommendation is to go to 750 million barrels?

Answer: There is no disagreement that the SPR represents a highly valuable instrument to enhance U.S. energy security. However, the question that remains is how much is enough? Quantitative analyses alone do not perfectly capture the strategic, national security and other non-economic benefits of the SPR, nor the real-world environment under which decisions are made on its use. Following are some of the more important strategic, national security and non-economic concerns relating to SPR size:

- National security/force deployment objectives--SPR stocks can be used to support mobilization and reduce dislocations to the civilian sector, and provide the benefit of preserving the option to use military forces based purely on national security and strategic concerns.
- Sustaining a free market strategy--The existing SPR sustains a policy of reliance upon market forces to allocate scarce supplies during a supply disruption.
- Drawdown policy--A large drawdown capability offers some benefits not directly related to size. Under circumstances where the SPR can place large volumes of oil into the market quickly, the SPR can serve to maintain market "liquidity."
- Providing additional time to address a crisis--In the event of future crises affecting oil supplies the current or projected SPR would assure coverage over a time-frame sufficient to provide the President a substantial response flexibility.
- Deterrence to politically inspired supply disruptions--The SPR discourages potential adversaries from engaging in disruptive activities because U.S. oil import dependency cannot be exploited in conjunction with other events.
- American international leadership on energy security--Continuing the build-up of strategic oil stocks by U.S. OECD partners remains important to assure mutual energy security. The United States is committed to achieving its goal of a 750 million barrel Strategic Petroleum

Reserve. We believe this commitment is important in demonstrating leadership, and building a cohesive international energy strategy.

Question: What effect would repeated use of the Reserve for less than drastic disruptions of supply have on the size of the reserve required, if any?

Answer: The 750 SPR provides ample coverage for multiple interruptions that are less drastic than the worst case interruptions used in the size study.

The best historical example of this coverage is to consider the two interruptions that occurred in the 1970's. In 1973-74, there was a 1.6 million barrels per day (MMB/D) shortfall for six months, or about 288 million barrels (MMB) in total, associated with the October Arab-Israeli War. Four years later, there was the 3.7 MMB/D disruption for six months, the largest of the last 40 years, that was caused by the Iranian Revolution. If a similar set of disruptions were to occur after the United States acquires the full protection of a 750 MMB SPR, then both disruptions could have been offset, barrel-for-barrel, by a U.S. SPR alone. Of course, in a foreign oil supply disruption any U.S. draw of SPR would be done in concert with a 2-3 MMB/D foreign strategic stock draw and some production from unused capacity. Therefore, it would be realistic to assume that about one-half the shortfall of these interruptions would have been offset by the U.S. SPR. In the case of the 1973 interruption, this would have amounted to about 150 MMB. For 1978-79, the amount would have been about 250 MMB. In either case, the 55 months between the interruptions would have provided ample time to refill. In the former, a fill rate of 91 thousand barrels per day (MB/D) would be needed and in the latter, 152 MB/D. Refill could be accomplished at far greater rates if needed.

The disruption probability estimates provided by the CIA imply that the probability of a range of worst case disruptions is small, and consequently, the probability of back-to-back worst case type disruptions is extremely small and does not significantly affect the outcome of the probability weighted cost benefit analysis. Using the CIA probabilities, the chance of two or more worst case disruptions (not necessarily back to back) in 30 years is less than 2 percent.

The Strategic Petroleum Reserve is intended to be used in severe disruptions, and not minor ripples in the market price of oil. All but one of the U.S. SPR storage facilities are designed for four to five complete fill and drawdown cycles; frequent use of the SPR for less than a "severe energy supply interruption" would limit the life expectancy of the storage caverns.

Regional Petroleum Reserves

Question: Hawaii, the West Coast and New England have often argued for regional storage of crude oil or petroleum products. Have you done any studies on such reserves? If so, with what results?

Answer: Regional Petroleum Reserves (RPRs) have been a subject of analysis ever since the Strategic Petroleum Reserve was authorized in 1975. The most in-depth study of RPR feasibility was the Report to Congress dated December 31, 1982, produced in compliance with the Energy Emergency Preparedness Act of 1982. The report concluded that centralized storage of crude oil in Gulf Coast salt domes is the most flexible, cost-efficient, secure and environmentally safe storage method, and that reliance on the marketplace is the best assurance that all regions, including noncontiguous and import-dependent states, will receive an equitable share of available supplies. Although the report recognizes the legitimate concerns of some regions regarding their vulnerability to decisions made elsewhere in an interdependent economy, it points out that an RPR, within the Strategic Petroleum Reserve (SPR) program mission, could not address these concerns, because RPRs would not be 1) a source of protection independent of national SPR use, 2) available for use under conditions insufficient to trigger an SPR drawdown, or 3) a source of oil priced substantially below spot market prices during an interruption.

The RPR issue was reexamined, as a possible SPR expansion option, in the Report to Congress, Expansion of the Strategic Petroleum Reserve to One Billion Barrels, issued in April, 1989. The report concluded that New England, Hawaiian and Caribbean RPRs would be excessively costly to construct and maintain, and that noncontiguous regions can be equitably supplied by marine tankers from centralized Gulf Coast storage.

Presently, the Department is opposed to legislation requiring Regional Petroleum Reserves.

Question: Have you looked at the emergency ability to ship oil "east-to-west" in oil pipelines currently shipping oil "west-to-east" from the West Coast?

Answer: DOE has informally explored the feasibility of using "west-to-east" pipelines to ship oil "east-to-west". With few exceptions, pipelines are designed to operate in only one direction. Extensive, costly and time consuming modifications are required to reverse the flow direction of a pipeline. Further, as most U.S. pipelines, including the All American Pipeline, are telescoped, having varying wall thicknesses, the flow in the reversed direction is significantly reduced from the originally designed capacity.

The other pipeline system that might be reversed, the Four Corners/Texas-New Mexico System, is an exception to this general rule as the Four Corners segment of that system was originally designed to flow "east-to-west" and, hence, would not suffer concomitant capacity reduction if reversed.

Question: What kind of capacity exists?

Answer: There are two pipeline systems installed and operating that are currently being used to transport crude oil from "west-to-east". They are the All American Pipeline with a rated capacity of 300 MB/D and the Four Corner/Texas-New Mexico system with a more limited rated capacity of 60 MB/D.

Due to the "telescoped" construction of the line, thicker wall pipe immediately downstream from the discharge end of the pump stations, the All American Pipeline estimates the capacity of the reversed line would be about 240 MB/D, 20% less than current rated capacity. As the Four Corners segment of the combined Four Corners/Texas-New Mexico system previously ran "east-to-west until 1977, no reduction in rated capacity is anticipated if the system were reversed.

Question: What kinds of costs would be involved in reversing flow?

Answer: A rough cost estimate received from the All American Pipeline to reverse its flow is $50-$60 million. The pipeline company estimates that such a reversal would require at least 9 months to accomplish. Due to smaller diameter lines (16") and lesser rated capacity, the estimated cost of reversing the Four Corners/Texas-New Mexico system are $10-$20 million; this would require approximately one year to accomplish.

Question: Would an ability to do this also allow for a shorter time lapse for deliveries to Hawaii if ships could move oil directly from the West Coast to disruptions versus other areas of the country?

Answer: While shipments through reversed pipelines could allow a shorter time lapse for deliveries, there are other stumbling blocks to consider. For example, All American is not permitted to either receive or load tankers at its Pacific Coast terminal at Gaviota. The only Pacific Coast access All American has is through the "Line 90" segment of the Four Corners Pipeline in the Los Angeles/Long Beach area. That line segment has a current rated capacity of 60 MB/D.

Question: The Defense Department has been interested in West Coast reserves for some time. What is your assessment of the vulnerability of the West Coast to disruptions versus other areas of the country?

Answer: In 1988, a total of 1,869,005,000 barrels of crude oil were imported into the U.S. Of this total, only 73,642,000 barrels or 4% were sent to the west coast (PADD V). The only area of the country less dependent on imported crude oil was the Rocky Mountain area (PADD IV), which is landlocked and without direct access to imports by water.

Question: Do you believe current Strategic Petroleum Reserve capabilities are adequate to address such concerns?

Answer: The Strategic Petroleum Reserve which is situated in the U.S. Gulf Coast, is in the best location to respond to the needs of the nation during a disruption. In 1989, over two-thirds (67%) of the crude imports entered the U.S. through the Gulf Coast region. The SPR's distribution system has direct pipeline access to over 44% of the U.S. refining capacity plus a marine distribution capability of over 2 million barrels per day. This marine capability exceeds the total 1989 crude imports into the East Coast, West Coast, Hawaii, Virgin Islands and Puerto Rico. Marine shipments from the Gulf Coast can reach the East Coast in 6-8 days, the West Coast in 16-18 days and Hawaii in 20-24 days. This is adequate to meet the nation's requirements.

Question: The Geological Survey has recently completed a study on salt masses in Arizona capable of being considered for oil storage. Have you seen or commented on this study?

Answer: "Strategic Crude Oil Storage in Arizona Evaporite Deposits" is a study conducted by the U.S. Geological Survey in 1989 at the request of the House Armed Services Committee. The report is principally a detailed geological description of four evaporite (salts precipitated in former lakes) basins in Arizona.

The thrust of the report is strategic storage to supply Naval vessels based or visiting the California west coast. The report incorrectly states that Naval vessels use crude oil for fuel; actually, Naval vessels use what is termed a light "Navy distillate" and thus the crude would have to be refined. A conclusion of the report is that it would be feasible to store crude oil in these evaporite basins, particularly in the Red Lake area where thickness is in excess of 4,000 feet and the evaporite salt is primarily halite (NaCl), similar to SPR Gulf Coast storage media.

The following summarizes the Department's initial review of this report.

There are four "pros" to the report's recommendation.

- o The relatively thick deposits of natural salt (Red Lake) do provide good storage media.

- Three of the basin evaporite deposits are relatively large, over 20 square miles.
- Over half of Red Lake is managed by the Bureau of Land Management, and therefore available.
- With no population or wetlands problems, there may be low environmental siting impact.

Six "cons" are apparent.

- There is no water supply for leaching. The only local supply is ground water which has been historically overpumped in Arizona, resulting in rapid decline in ground water table; the Arizona Ground Water Management Act strictly controls ground water use. The area has negligible ground water recharge. For solution-mining, development of storage capacity seems virtually impossible unless one could pump from the Colorado River, about 40 miles away.
- Subsidence has been significant in the past due to heavy ground water withdrawal. Well casings have been known to be extensively damaged as a result.
- Assuming that water could be had for solution-mining, there is no known acceptable means to dispose of the brine--a major problem.
- Conventional mining, the only alternative to solution-mining, would most likely be prohibitive in cost.
- There is poor distribution capability. The nearest pipeline is 35-40 miles away, of small diameter, and used for domestic crude operations. In addition, the California coastline is approximately 200 miles away.
- The evaporite sites are in a moderate earthquake region.

Threats and Vulnerability

Question: Testimony last year indicated a continuing increase of threats to energy facilities in the United States. What is your current assessment of this activity?

Answer: We have seen an increase measure of sophistication in the technology, electronics, and weaponry being utilized by terrorist organizations in recent years. We know that there are terrorist elements in this world which are so committed to their causes and ideologies that they disregard the concern for favorable public opinion and may plan and carry out actions without regard for destruction and casualties.

Elements of this nation's infrastructure, in particular our energy networks, make for very attractive targets for terrorists. Fortunately, terrorists in this country have not yet focused heavily on these highly visible and often times vulnerable industrial key assets.

Terrorists select targets to provide the maximum damage and notoriety while expending a minimum amount of resources. As our nation's law enforcement efforts continue to prove successful against the traditional terrorist modes of violence, hostile groups will seek out new U.S. targets with a potential for greater impact. Energy facilities, pipeline systems, offshore oil systems and power generating stations are all examples of critical industrial assets with varying degrees of vulnerability. A successful terrorist attack against any one of these facilities could have serious consequences.

Question: Has the electric industry made changes in operations or modifications to facilities based on vulnerability assessment?

Answer: Yes. The Department raised a number of issues with the North American Electric Reliability Council (NERC), as a representative of the electric power industry, late in calendar year 1986, all related to vulnerability. In early 1987, the NERC formally undertook responsibility for conducting the necessary industry introspective study; it created a special committee for the purpose (i.e., the National Electric Security Committee, NESC). The NESC concluded its study in late summer, 1988, and reported its results and recommendations to the Board of Trustees, NERC, in October of that year. The Board approved all recommendations and directed the appropriate NERC committees to initiate implementation. While the implementation is not yet complete, significant progress has been made.

While the industry report has been designated "proprietary", a topical summary of some initiatives may be informative.

A data base is being created showing ownership and design/performance characteristics of spare extra-high-voltage transformers.

A generic equipment sharing agreement has been developed as an expedient to emergency action.

Guidelines will be changed regarding the location of backup Control Centers relative to the location of primary Control Centers.

> Communications requirements are being reviewed and high priorities established for the restoration of critical communications facilities.
>
> A sabotage readiness program is being developed which will include periodic tabletop exercises with participation by key operating and planning personnel from each utility.

In these endeavors, the electric power industry has served as a model for the other energy industries due to their innovation and commitment to vulnerability reduction.

Energy Emergency Preparedness

Question: Other than the plans for use of the Strategic Petroleum Reserve, what other response mechanisms are in place for energy emergencies?

Answer: The Office of International Affairs and Energy Emergencies (OEE) has developed a number of programs and on-going response activities for dealing with energy emergencies. One of the key elements in responding to energy emergencies is the Energy Emergency Management System (EEMS). The EEMS is a generalized emergency response process that provides systematic decision-making in response to an energy emergency, whether in oil, gas, coal, or electric power industries. OEE also has a number of additional programs for responding to international and domestic emergencies.

International energy emergency preparedness is facilitated through U.S. participation in the International Energy Agency (IEA) and the North Atlantic Treaty Organization (NATO). Membership in the IEA provides the U.S. a means of coordinating SPR drawdown with the drawdown of other members' emergency reserves, and for participation in the IEA emergency sharing system, should it be triggered. The NATO Petroleum Planning Committee (PPC) in which we participate, focuses on ensuring that essential civilian needs are met at times of crisis and war.

Domestic response mechanisms cover a wide range of planning activities and programs targeted to deal with specific threats to energy security. DOE has in place a notification system to alert the energy industry on threatening situations. A public information and state liaison program communicates information between DOE and the states on the status of the emergency, encourages voluntary demand restraints, and generally helps citizens cope. The National Defense Executive Reserve program develops, trains and maintains units composed of energy industry professionals to augment DOE's energy management activity during national security emergencies.

Programs and authorities necessary for responding to emergencies associated with a specific energy supply are available for implementation. Authorities contained within the Natural Gas Policy Act, the Public Utilities and Regulatory Policy Act and the Federal Power Act contain specific authorities that could be used by DOE for responding to a natural gas emergency or an electrical emergency.

Regional Staff

Question: The budget justifications (page 463) refer to "regional staff". Where are the regional staff and how many are there?

Answer: The regional staff is composed of two types of personnel: regional team leaders and planning staff who are DOE employees located at six Operations and Support Offices of the Department of Energy; and National Defense Executive Reservists (NDERs) who are employed by private industry but who are designated to assist the Government during national security emergencies.

The Operations and Support offices, located in Boston, Massachusetts; Aiken, South Carolina; Chicago, Illinois; Albuquerque, New Mexico; Idaho Falls, Idaho; and Richland, Washington provide 18 people for the Regional Emergency Management Teams (REMTs), while the remaining 96 team positions are staffed with NDERs. These NDERs come from almost every state in the continental United States as their function is to provide the regional teams with knowledge of, and contacts within, the companies that own and operate energy systems.

In summary, the regional staff has approximately 114 persons located across the length and breadth of the "Lower 48" states.

International Emergency Preparedness

Question: The budget justifications (page 468) in FY 1990 includes an analysis of "the need for an IEA negotiation strategy." What is the perceived need?

Answer: Under the 1984 International Energy Agency (IEA) Governing Board Decision on Stocks and Supply Disruptions, the U.S. and other IEA member countries are committed to coordinating their emergency response in oil supply disruptions. The level of U.S. emergency response would, therefore, depend not only on the nature and magnitude of the supply disruption, but also on our allies' ability and willingness to respond in an emergency. Largely at the urging of the U.S., the IEA has established a response mechanism, known as the Coordinated Emergency Response Measures (CERM), which provides a framework for formulating a collective IEA response. Through the consultative process, IEA member countries would attempt to coordinate and negotiate on the appropriate levels of their response. Thus, there is a need for the U.S. to develop a negotiation strategy to formulate an effective IEA response and, at the same time, determine the appropriate level of U.S. emergency response, which, in certain circumstances, may involve drawdown of our SPR at less than maximum rate.

Question: Explain what this analysis is to accomplish.

Answer: In order for the U.S. to develop an effective negotiation strategy, we need the analytical capability to evaluate our allies' capabilities to respond in an emergency, their ability and willingness to implement emergency response measures, and the implications for alternative U.S. response options, including less than maximum SPR stockdraw. A rigorous analysis on these issues would help the U.S. representatives at the consultative meeting in negotiating and formulating effective IEA response.

Question: The budget justifications (page 469) indicated in FY 1991 suggests a study "to determine the impact of converting military demand for petroleum products under the implementation of the single fuel concept". What does this study intend to do and what is its significance?

Answer: The intent of this study is to analyze the kerosene-based jet fuel supply/demand relationship through the year 2000, to determine if refiners worldwide will have the capability to produce sufficient quantities to meet anticipated military and essential civilian demand under a disruption and stress scenario. Issues to be evaluated will include impacts on U.S. refining structure, trading, security and military fuels supply options. The study will identify potential regional shortfalls.

This study stems from NATO's goal to convert to a single fuel on the battlefield in Europe by the year from 2000 and, from the more recent decision by the U.S. Air Force to convert the military requirement for naphtha-based jet fuel (JP-4) to kerosene-based jet fuel (JP-8) on a selective basis within the United States.

Defense Production Act

Question: What are your responsibilities under the Defense Production Act? Are you equipped to meet them?

Answer: The Defense Production Act of 1950 (DPA) has served as the cornerstone of the Nation's industrial and resource mobilization structure. The DPA does not confer responsibilities but rather provides key authority basis for emergency preparedness and for the readiness of the Nation's industrial resources. As a note of clarification, it is Executive Order 10480 (now undergoing revision within the Executive Branch) that confers the DPA responsibilities amongst the various agencies and departments.

The major DPA provisions that address emergency preparedness efforts include:

Title 1

- Section 101(a) authorizes the priority performance of contracts and orders and the allocation of materials and facilities, as necessary or appropriate to promote the national defense. Section 101(a) authority is not available to control the general distribution of material in civilian markets unless further findings required by Section 101(b) of the DPA are made, i.e., that the material is a "scarce and critical material essential to the national defense," and that the national defense requirements cannot otherwise be met "without creating a significant dislocation of the normal distribution of such material in the civilian market to such a degree as to create appreciable hardship."

- Section 101(c) authorizes the allocation of, or the priority performance under, contracts or orders relating to supplies of materials and equipment in order to maximize domestic energy supplies, if the President makes certain findings with respect to the need for the materials or equipment for the exploration, production, refining, transportation, or conservation of energy supplies or for the construction and maintenance of energy facilities.

Title 7

- Section 708 authorizes the formation of "voluntary agreements" to help provide for the defense of the U.S. through the development of preparedness programs and the expansion of productive capacity and supply.

- Section 710 authorizes the President to train and employ persons from the private sector in order to facilitate planning for and responding to emergencies.

The ability to utilize the DPA for emergency preparedness objectives depends on the effectiveness of the available DPA authorities. Currently, the Administration is seeking amendments to the DPA to include:

  - restoring the President's authority to waive conflict of interest laws for activated National Defense Executive Reserves (NDERs);

- enhancing the utility of voluntary agreements by redressing limitations in the existing antitrust protection; and

- clarifying the applicability of the allocation and priority contracting authority to service contracts.

These amendments will provide authorities helpful to DOE in more effectively carrying out emergency functions by: utilizing voluntary agreements to fulfill international agreement obligations of the U.S.; facilitating the role of NDERs; and assuring that adequate services are available to implement drawdown of the Strategic Petroleum Reserve (SPR).

The ability of DOE to utilize these authorities expeditiously in an emergency depends on the severity and frequency of emergencies. As energy systems become less resilient due to lack of slack capacity combined with oil import dependency, the likelihood and severity of disruptions could increase. To the extent that this results in widespread supply problems that cannot be resolved on a case by case basis, a more general application of the authority might be needed. It is anticipated that in a large national crisis DOE staff efforts would be supplemented by use of the NDERs as needed to help implement Title I DPA authorities on a large scale basis.

Tests and Exercises

Question: What kind of issues have surfaced as a result of tests, exercises and simulations and what is their significance?

Answer: Effective testing and exercise programs allow an organization to: 1) identify needed improvements; 2) clarify roles and responsibilities; 3) train staff; and 4) "network" with key participants.

Through such testing efforts, DOE has revealed problems in both internal and external communications and coordinating responses, and is continually improving its emergency program in view of these results.

Other issues concern the interface between emergency office staff and other Departmental organizations that are normally involved in an energy crisis. While we have approaches designed to enhance coordination among our offices, too often the coordination has been insufficient. Continued testing can draw these elements together into a more focused, problem solving entity.

Similarly, testing has revealed a need to improve our outreach program to meet demands for additional expertise during regional energy crises. Consequently, our testing seeks to develop a skilled and flexible cadre who, through their knowledge of energy, can support states and localities during a regional crisis.

We have also learned that U.S. energy systems, especially the electric power infrastructure, are vulnerable to catastrophic natural events and other disasters. Moreover, their repair and restoration are essential to providing all other services (e.g., medical care, water, food, transportation and communication).

Finally, we've learned that U.S. economic well-being requires speedy restoration of energy systems because of the interdependency between regions of the country in terms of energy.

National Defense Executive Reserves Training

Question: What kind of training is provided to the National Defense Executive Reserves (NDER)?

Answer: The members of DOE's NDER units are provided with orientation about DOE's programs, explanations about emergency responsibilities and authorities, information about public concerns during an emergency, and participate in emergency simulations.

Question: Who conducts the training and where is it held?

Answer: DOE Energy emergencies staff conducts the training, with assistance from Lawrence Livermore National Laboratories staff, and the staff of the DOE Central Training Academy (CTA). The training is usually held at the CTA facilities in Albuquerque, NM, but may be held at any location convenient for DOE and the Reservists.

Natural Gas

Question: Under "Energy Emergency Management" (page 475) there is an emphasis on natural gas. Why?

Answer: The natural gas industry is undergoing dramatic and fundamental changes, as deregulation and growing demand drive a continuing restructuring of the marketplace and realignment in the traditional relationships between producers, pipelines, local distribution companies (LDC's) and consumers. These changes have highlighted a number of concerns about the fragile balance in the supply/distribution and the demand for natural gas. For example, the vulnerability of many low priority natural gas consumers to curtailment in their service was clearly evident during the severe cold spell in December of 1989, as many pipelines were unable to meet peak local demand. More fundamentally, low natural gas prices over the past few years have discouraged the development of natural gas reserves, which are not keeping pace with the growth in demand. This supply constraint may impact fuel switching and other emergency options as demand for clean fuels continues to grow.

As noted above, there are a number of factors increasing the stress level in the natural gas industry. This is likely to heighten the probability of local and regional natural gas emergencies. As a consequence, DOE may be called upon to play a major role.

Emergency Preparedness in the States

Question: What is your assessment of the overall ability of the States to respond to energy emergencies?

Answer: The States' ability to respond to an energy emergency is highly variable, depending on the State and the nature of the emergency. States such as California have an excellent staff and sufficient funding to do a good job. Some States devote only part-time for one person, and thus have limited capability. In general, DOE has been pleased with the increased priority States have placed on emergency preparedness.

Question: Is this ability improving or decreasing?

Answer: This is the third year that DOE has sponsored Federal/State regional meetings on emergency preparedness cooperation and coordination. States' awareness of energy emergency preparedness issues has improved; however, their resources and capabilities to respond to energy emergencies are variable.

Question: What specific activities are you undertaking to improve this capability?

Answer: To help the States improve their energy emergency response capabilities, DOE has jointly sponsored with the States a series of regional seminars and emergency simulations in 1988, 1989, and again in 1990. The first of these, this year, was held in New Hampshire, March 19-21. These seminars/simulations focus on the importance of coordination among industry, State, local and federal representatives and emphasize the value of testing plans in a non-emergency setting. A "Guidelines" publication is being prepared which develops an outline of the programmatic content that should be included in State energy emergency plans. This outline can be used to help States develop their own plans or enable States with out-of-date plans to update them. Also, DOE plans to develop a computerized State set-aside program, and make it available to all States.

General

Question: Both your personnel level (71 FTEs) and total compensation remain the same in FY 1991 versus FY 1990, (page 495). How can this be accommodated with pay increases expected in 1991?

Answer: The amounts reflected in FY 1991 for personnel compensation do not allow for the effects of the 1990 pay raise. If we are unable to accrue "savings" from normal attrition, funds will have to be reallocated.

Question: Assuming the same personnel and full payment of pay increases anticipated in 1991, do you need added funds? If so, how much is needed?

Answer: If we do not realize attrition as stated above, approximately $150,000 would need to be reallocated; however, we feel that the budget request fully provides for the needs of the program.

QUESTIONS SUBMITTED BY THE HONORABLE RALPH REGULA

Dependence on OPEC Oil

Question: During a speech given by OPEC Secretary General Subroto at the Cambridge Energy Research Associates annual executive conference (Feb. 1990) the following points were made. World oil demand is growing. Choices to supply the growth are very limited. Non OPEC production is about to level out and begin a long decline.

He believes that it is necessary for governments of consuming nations to "cooperate" with OPEC in obtaining the capital needed to increase OPEC's productive capacity. If consuming nations want to make sure there is enough oil for growing economies in the 1990's, the Secretary stated that approximately $60 billion will be needed to boost OPEC's productive capacity another 6 million b/d by 1995. Only 10% of the capital can be funded internally by OPEC.

The unspoken warning is that lack of such cooperation may result in a more expensive circumstance later.

OPEC appears to be regaining its strength. Is anything being done to prevent the increased dependence on OPEC that Secretary General Subroto is predicting?

Answer: With regard to Secretary General Subroto's concern about capital to increase OPEC's productive capacity, we believe that if producers offer terms that are sufficiently attractive, and since world capital markets are efficient, then financing will be made available for oil production capacity. We do not think it is necessary or appropriate for consuming nations to intervene and ensure that the capital is available.

Preventing increased dependence on OPEC oil if it is the lowest cost oil available to advanced economies can be costly. In the late 1970's, the U.S. embarked on an import substitution strategy including an $88 billion synthetic fuels program, and comprehensive U.S. Government efforts to lower energy consumption, such as building temperature controls, etc. What we learned from that experience is that these types of actions are very costly, and do little to reduce U.S. dependence on OPEC oil.

This is not to say that we should do nothing. Rather, the U.S. should take actions that reduce or eliminate unnecessary, counterproductive impediments to letting energy markets function efficiently and effectively. The Administration has already moved forward on certain measures such as passage of natural gas wellhead price decontrol legislation, a proposed program of federal tax incentives for domestic oil exploration and production, a recently announced 11-point conservation and renewable energy initiative, and implementation of the Alternative Motor Fuels Act of 1988.

All of these are economically sound and will reduce dependence on OPEC oil.

Also, we continue to fill the SPR, which is now approaching 600 million barrels, to its 750 million barrel ultimate size and we continue to stress similar actions be taken by our import-dependent allies.

In addition, as part of the National Energy Strategy review, we will intensely assess existing policies/programs and options thereto, focusing on areas where impediments exist to the energy market. Such areas include removing statutory and regulatory barriers, more effective research and development in a number of areas, increased conservation and the development of alternative fuels.

Question: What studies have you done on the effect that this increased dependence will have on our future energy supplies? At what level of imports do you foresee the effect being catastrophic?

Answer: Dependence on imports of oil is a very misunderstood concept. If oil imports were cheap and 100 percent reliable, we would have little reason to be concerned since the U.S. economy would benefit substantially by having such cheap oil.

Therefore, the concern should be on the extent to which world oil supplies are subject to sharp curtailments or subject to monopolistic pricing powers by any of its producers. A given level of U.S. imports per se has no direct relationship to causing either sharp curtailments in supply or monopolistic pricing actions by producers.

In the event of sharp curtailments or reductions in supply, the U.S. and its allies would suffer economic losses and increased security risks. This is why strategic petroleum stocks have been built since the 1970's. Nearly one billion barrels are now held by the U.S., Japan, and West Germany and there are plans to increase this to 1.3 billion barrels by the mid 1990's.

Significant monopolistic pricing power has been exerted by OPEC in the past and there is a risk that it could happen again. However, it is clear that when oil prices achieved record levels in the early 1980's, oil consumption declined, non-OPEC energy production increased, and oil prices collapsed. This can be the result of imposing high prices.

The United States, by relying on markets and removing impediments, can do its part to assure competiveness in world oil markets. If oil prices were to increase, over time U.S. consumers would conserve or switch to other fuels resulting in less demand for oil. History has shown that an OPEC high price strategy, even with significant oil import levels, is difficult to maintain.

Rather than becoming totally preoccupied with imports, the U.S. is far better served by maintaining flexibility through the use of markets coupled with the SPR and efforts to improve technology, information to consumers and the removal of market impediments. Being aware of import levels is certainly a consideration in a national energy strategy as long as it does not become the goal or central strategy as it did in the late 1970's with disastrous results.

Question: Have you done any analysis of Secretary General Subroto's "request" for capital? If not, why not?

Answer: The Department of Energy has not done an analysis of the cost of increasing production capacity within OPEC or of OPEC's ability to finance the additional production capacity.

The Department believes that the market will function to supply the financing for capacity expansion plans if the producing countries provide suffient incentives to make investment opportunities attractive. We have closely followed reports regarding plans to expand capacity as well as the costs of adding such capacity. In addition, a team from DOE recently visited Saudi Arabia, Kuwait, Iraq, and the United Arab Emirates (U.A.E.) and discussed these countries' plans for capacity expansion and the projected costs involved.

We discovered that the estimates varied widely, as did the variables included in each estimate. Secretary General Subroto's estimate raises a number of questions, such as whether the operating costs of the new production capacity are included, and which countries within OPEC are assumed to add to capacity. Adding to capacity in Saudi Arabia, Kuwait, the U.A.E., and, to a lesser extent, Iraq, is likely to cost substantially less than adding production capacity in other OPEC countries, such as Algeria, Ecuador, and Gabon. These latter countries lack the financial, and possibly geological, resources to add production capacity.

Due to these uncertainties, DOE has not attempted to analyze the cost of expanding production capacity. The Department intends to continue monitoring OPEC's capacity expansion plans and their projected costs. For further detail, see the answer to the first question of this series.

Question: What percentage of this $60 billion do you predict that the U.S. would be expected to contribute?

Answer: To put OPEC's estimates of $60 billion in perspective, at today's prices and output levels, OPEC revenues are likely to be well over $1 trillion for the next 10 years. OPEC also has proved and indicated additional reserves, estimated at 694-759 billion barrels. While some producers are heavily in debt and need all surplus oil revenues to meet obligations, others are not. Most OPEC producers in the Persian Gulf region may well be able to finance additional capacity out of expected cash flow, or certainly are able to borrow. Less prosperous OPEC members may lack internal resources to fund capacity expansion. They also frequently have prohibitions against foreign investment in their oil and gas industries that may impair them from obtaining private sources of capital. To attract capital, these countries would need to modify these barriers to investment. With appropriate terms, needed capital could be raised. We do not believe the governments of consuming countries need to intervene and provide such capital. For further detail, see the answer to the first question of this series.

Likelihood of Another Energy Crisis

Question: What is the likelihood of another energy crisis occurring if the consuming nations do not cooperate with OPEC to help boost their productive capacity? Should we be anticipating another supply disruption like the one in the 1970s?

Answer: We believe that the likelihood of a worst-case supply disruption is very low and declining. Smaller disruptions similar to those of the 1970s are also unlikely. But should one occur, U.S. and foreign strategic stocks could be effective in mitigating price increases. The important point to remember with regard to the issue of supply disruptions is that the world oil market is much changed since the late 1970s, and is much better prepared to deal with such events.

The United States now has strategic stocks of over 580 million barrels in the Strategic Petroleum Reserve and is continuing to build these stocks to achieve the 750 million barrel goal. Our allies in the Organization for Economic Cooperation and Development and the International Energy Agency (IEA) also have sizable strategic stocks to call upon in the event of a disruption, and we have worked closely over the years to coordinate our policies and plans with them, should a disruption occur. By the end of 1990, the U.S. SPR alone will provide the capability to offset, barrel-per-barrel, and for six months, an interruption of 3 million barrels per day. IEA government controlled stocks would add, if necessary, and additional minimum of 2 million barrels per day. Fuel switching and potential incremental supplies from existing excess world production capacity would also provide substantial offsets of as much as 4-6 million barrels per day between now and 1995. By 1999, the 750 million barrel U.S. SPR alone will have the capability to offset, barrel-per-barrel, and for six months, an interruption of 4.0 million barrels per day. Such an interruption would be larger than any experienced in this century. For reference, the Iranian revolution of 1979 reduced world oil supplies by 3.7 million barrels per day for six months (a loss partially offset by increased production by other nations), and the 1973-1974 oil embargo reduced world oil supplies by 1.6 million barrels per day for five months.

Other changes in the world oil market over the last decade tend to decrease the probability of severe supply disruptions. These include a recognition by OPEC members that sudden price increases result in market responses such as increased conservation, fuel switching, adoption of alternative energy technologies and increased production by non-OPEC producers. In addition, some OPEC member nations have made significant investments in downstream operations in consumer countries. Major supply disruptions would undermine the profitability of these investments. It is worth noting that the supply disruptions in the 1970s took place when IEA strategic reserves were non-existent or very limited and at a time when no major producer had invested in downstream operations in IEA member countries.

Analysis of SPR Size

Question: The Strategic Petroleum Reserve now contains 580 million barrels. Secretary Watkins has asked Congress for authority to negotiate leasing agreements on crude oil to fill the SPR. He says that a DOE report concluded the SPR will be adequate when it is expanded to 750 million barrels, not one billion barrels.

Relying solely on direct purchases, completing fill of a 750 million barrel reserve by 1996 would cost about $3.5 billion in oil purchases alone. Filling to one billion barrels by 2005 would cost $15 billion. If Secretary Watkins' recommendation is accepted, it would generate a substantial savings. What was the original SPR amount of one billion barrels based on?

Answer: The Energy Policy and Conservation Act of 1975 (EPCA) (Public Law No. 94-163), authorized the creation of a Strategic Petroleum Reserve for the storage of up to one billion barrels of petroleum products. The one billion barrels is the maximum size authorized. At the time the one billion barrel amount was authorized by EPCA, there was no analytic or substantive basis for selecting the maximum SPR fill level. The EPCA required that an SPR of approximately 500 million barrels be developed by 1982. The 500 million barrel size was based on the total volume of crude oil imported into the U. S. in the three consecutive months during the 24-month period preceding the date of enactment of EPCA in which the average monthly import levels were the highest. The legislation also called for an SPR Plan to detail, among other things, the volumes and types of petroleum products to be stored. The SPR Plan submitted to Congress in 1977 recommended a Reserve size of 500 million barrels of centralized crude oil storage based on a wide range of factors.

As part of continuing reassessments of the SPR program, the 1978 SPR Plan Amendment No. 2 amended the SPR Plan to increase the Reserve size goal to one billion barrels based on the need perceived by the Administration at that time. However, that

Administration only proceeded with implementation of a 750 million barrel SPR. Plan Amendment No. 2 included a plan for achieving 750 million barrels but deferred action on the remaining 250 million barrels. Reassessments in 1982 and 1986 supported the 750 million barrel size as did a 1987 DOE report to the President on energy security. The Bush Administration policy has been to complete a 750 million barrel SPR. The extensive analysis of economic, national security and foreign policy factors contained in the interagency study forwarded to Congress on February 2, 1990, reaffirmed the 750 million barrel goal.

Question: How does your analysis justify the change in level of protection in light of our increased dependence on foreign oil?

Answer: The Bush Administration has consistently maintained a policy of completing a 750 million barrel SPR by the later 1990s. As was discussed in response to earlier questions, import levels are one of the many factors that determine a country's energy security.

The change in the level of protection afforded by the SPR as measured by net import coverage is only one, and at best, a misleading measurement of increased or reduced vulnerability to oil supply disruptions. Net import values are relative because it would be implausible for the U.S. to lose more than half of its oil imports even in a worst case disruption. Net import coverage also does not take into account policy and technology changes which may increase domestic oil production, reduce consumption and imports, or do both.

No single indicator can be used as a measure of vulnerability to energy supply disruptions. By itself, dependence on imports of crude oil and petroleum products is definitely not such a measure. Many indicators of conditions in oil and other energy markets, of response capabilities, and of the real risks of disruption need to be considered -- within a global context -- in order to assess the overall outlook for energy security. That broad range of market indicators is being monitored continuously.

Attached is an excerpt from recent Departmental testimony that summarizes the Administration's analysis of the size issue in greater detail.

Question: What percentage of our domestic oil supply did imports constitute in your analysis?

Answer: In the Energy Information Administration's long-term oil forecast that was used in the SPR size study transmitted to Congress in February, 1990, annual projections of U.S. imports and demand were made at five-year intervals, using three ranges of price projections, low, mid, and high. Calculating dependence on imports by dividing gross imports by oil demand (product supplied)

Statement of Robert H. Gentile
Assistant Secretary for Fossil Energy
United States Department of Energy
to the
Committee on Appropriations
Subcommittee on Interior and Related Agencies
on
March 29, 1990

II. SIZE OF THE SPR

The appropriate size of the SPR has been the subject of considerable interest and review ever since the inception of the SPR program. Although the storage goals have been revised over the past 15 years, this Administration's policy has been to complete a 750 million barrel SPR by the late 1990's. Public Law No. 101-46 required the Secretary of Energy to transmit a report to Congress on alternative means to finance the SPR. In signing this legislation, the President also directed that an interagency study be undertaken on the appropriate size of the SPR. Both studies were submitted to Congress on February 2, 1990.

The Administration believes that the development of a 750 million barrel SPR is an appropriate and prudent oil stockpiling policy for the United States. The Administration arrived at this decision after undertaking an exhaustive analysis of a broad range of economic, foreign policy and national security factors. The results of the analysis were reviewed by the President's Economic Policy Council whose members unanimously supported the 750 million barrel goal.

I would like to share with you, at this time, some of the thinking which has gone into this decision.

First, the United States possesses the world's largest Government owned petroleum stockpile. The SPR is also one of the largest direct investments by the Federal Government in the energy sector, and serves both as a powerful deterrent against oil supply disruptions and as an effective instrument to minimize damage to the economy if such disruptions should occur. The question before the Congress and the Administration is, therefore, not one of whether to have a large SPR; we have one. Rather, the question is whether expanding the SPR beyond 750 million barrels is necessary or justified.

The Administration believes that expansion beyond the 750 million barrel goal would be inconsistent with current understanding of market and geopolitical conditions and of their evolution during the last decade. Such an expansion would aggravate budgetary constraints; increase U.S. oil imports (through purchases of SPR oil) that add to trade imbalances; and possibly serve as a disincentive to the expansion of strategic reserves held by our allies. Expanding the SPR from 750 million to one billion barrels would necessitate an increase in direct budget outlays estimated in excess of $12 billion. Ultimately, we also need to ask whether there might be ways to use our limited resources to enhance our energy security more productively than continuously increasing the Government's stockpile of oil. Are there better, more cost-effective ways to improve our energy health, rather than simply buying an increasing amount of expensive insurance? The SPR investment must be considered comprehensively in the context of other public and private investments that have the potential to provide cost beneficial improvements in energy security, such as improved energy efficiency, increased research and development of renewable and other energy sources, enhanced domestic oil and gas production techniques and fuel flexibility. Expanding the SPR to 1 billion barrels may actually divert resources from these other, potentially more cost-effective, measures. The Department is addressing these issues on a broader scale in fashioning the National Energy Strategy.

Second, expansion of the Reserve beyond the planned level of 750 million barrels is neither cost effective nor likely to measurably affect United States energy security. A key finding of the size study is that the incremental benefits of increasing the SPR from 750 million barrels to one billion barrels are far outweighed by the additional costs. The present value cost of moving from 750 million to 1 billion barrels would be $3.37 billion with benefits of $0.75 billion and a cost benefit ratio of 4.5 to 1.0. We have far exceeded our stockpiling commitments under the International Energy Program (IEP) Agreement which in 1974 created the International Energy Agency (IEA). The IEP criterion of 90 days of net imports includes not only government owned strategic stocks, but also large portions of U.S. private sector inventories. For IEA purposes, United States oil stocks (SPR and private) currently are equivalent to 209 days of net imports. (This includes 81 days of SPR oil, and 128 days of petroleum industry commercial stocks, 23 days of which are above minimum operating requirements.) Even though our oil imports are increasing, so is the SPR which at 750 million barrels will continue tc exceed our IEA stockpiling commitments. Just counting the 750 million barrel SPR and private stocks above minimum operating requirements, the United States is still projected to have net import coverage of approximately 90 days in the year 2005. Moreover, even in the event of a severe interruption, it is highly unlikely that the United States would lose more than half of its imports.

Further, we believe that the economic effects of a broad range of potential supply disruptions can be mitigated through use of existing and planned strategic stockpiles held by all consuming nations, especially by IEA member states. The coordinated use of these stocks would provide protection against a range of worst case disruptions of a magnitude significantly greater than any disruption experienced in the last forty years.

Today, we are substantially better prepared to deal with an oil supply interruption than we were in 1979. By the end of 1990, there will be the potential to offset, for six months, a loss of between 8 and 13 million barrels per day of oil supply, or a maximum of 25 percent of free world consumption, assuming all excess capacity, including that in the Middle East, is used. The U.S. SPR alone will provide the capability to offset, barrel per barrel, and for six months, an interruption of an average 3 million barrels per day. IEA government controlled stocks would add, if necessary, an additional minimum of 2 million barrels per day. Fuel switching and potential incremental supplies from excess world production capacity would provide offsets of between 4 and 7 million barrels of oil.

For reference, the Iranian revolution of 1979 reduced world oil supplies by 3.7 million barrels per day for six months, a loss partially offset by increased production by other nations. U.S. imports from Iran were about 550,000 barrels per day in 1978. This interruption was the largest oil market disruption of the last quarter century. In comparison, the 1973-74 oil embargo reduced world oil supplies by 1.6 million barrels per day for five months. To further place in perspective the maximum total free world offset of 25 percent, and U.S. coverage capability, the 1973-74 oil embargo eliminated 3.4 percent of consumption, and the 1979 Iranian disruption eliminated 7.6 percent of consumption. By 1999, the U.S. SPR alone will have the capability to offset barrel per barrel, and for six months, an interruption of an average 4.0 million barrels per day. Such an interruption would be larger than any experienced in this century.

Foreign policy and national security agencies that participated in the Administration's study provided an in-depth review of strategic considerations affecting SPR size, including assessments of national security, military preparedness and foreign policy objectives. These strategic and other non-economic factors are now, as they have been in the past, also central to policy decisions on SPR size. Based on this extensive study, it is the judgment of the Administration that a 750 million barrel SPR provides substantial protection against a range of worst case disruptions and ample deterrence against embargoes. Increasing the SPR to one billion barrels would not materially affect these factors.

Third, because of the discretionary character of expansion beyond 750 million barrels, we need to be prudent in undertaking further investment in the Reserve, carefully weighing the expected budgetary costs against the marginal benefits that a larger SPR might provide. From the analysis we have conducted on the advantages and disadvantages of alternative sizes, it is apparent that the SPR should be evaluated as an insurance policy. When the anticipation of a range of worst case disruptions is very low, which is our current judgment, the high cost of maintaining insurance above a reasonable level is not justified.

The participating agencies in the Administration's recent study have concluded that the chances of a disruption of the magnitude requiring expansion from 750 million barrels to one billion barrels are not anywhere near high enough to warrant such an expansion.

In the current world environment, major disruptions run counter to the self-interests of both producers and consumers. Any substantial disruption of output from one or more of the larger producers, which would be necessary for a major disruption, would undermine the profitability of their large downstream investments in consumer nations, substantially reduce their income from oil production which for many is the sole source of national revenue, and cause them to lose market share. Consumers would react to the higher oil prices engendered by a disruption by increased conservation, fuel switching, adoption of alternative energy technologies, and development of hydrocarbon resources outside the geographic area involved in the disruption. This is the pattern that emerged from previous disruptions which, notably, took place when IEA strategic reserves were non-existent or very limited, and at a time when no major producer had invested in downstream operations in IEA member states.

In sum, the Administration believes that the SPR study submitted to Congress on February 2, 1990 represents the best current assessment of conditions and concerns related to SPR policy objectives. Both at current and projected levels the SPR reflects a strong U.S. commitment to minimize the effects of a range of worst-case disruptions of the international oil market.

using the mid-range price projections results in the following percentages:

1990: 44%
1995: 53%
2000: 56%
2005: 59%
2010: 64%
2015: 68%
2020: 72%

Question: How does that percentage compare to the record level reached this past January? In January, imports constituted 54% of our domestic consumption.

Answer: The January gross imports as a percentage of demand (product supplied) exceeded the annual import dependence calculation projected for 1995. However, imports in January were unusually large due to the need to replenish inventories of petroleum products, principally distillate fuel oil, following the extremely cold December (when imports were only 40% of consumption). Gross imports for 1989 averaged 46% of demand, and following the unusually high import level in January, 1990, preliminary estimates for February indicate a gross import level which is 46% of demand.

Question: DOE states that the International Energy Agency member countries have built strategic stocks totaling nearly 1 billion bbl and 9-13 million b/d of surplus world productive capacity which could be tapped in the event of a disruption. How long will it take to actually tap these stocks? Will they be accessible to the U.S.?

Answer: As in the United States, the drawdown of emergency reserves by other IEA member countries would be initiated by a decision by their governments. Most IEA members state that they are prepared to reach such a decision within two or three days, although several say that it will take about a week. Following such a decision, strategic stocks in most countries would be available immediately. Additionally, some 780 million barrels of commercial stocks held by companies at refineries and storage terminals could be drawn down and processed or distributed as part of the normal course of industry operations. Some countries (e.g., Germany) hold a large portion of government-controlled stocks in separate stockholding entities, but these storage sites are well integrated into their petroleum distribution systems. As the world oil market is highly integrated, any increase in the volume of available oil, no matter what the source, will serve to mitigate a disruption. While the United States might not receive the physical barrels released from other members' reserves, the operation of the market will effectively increase U.S. and all other countries' supply as a result of such drawdown.

DOE's current estimate of world unused production capacity is 5 to 6 million barrels per day, which is expected to decline in the future as worldwide demand for oil grows.

Question: Do you believe that a 750 million barrel reserve will truly provide substantial protection for the US? What is your estimate of the lowest amount that the SPR could be filled to and yet provide adequate protection?

Answer: Many factors such as the nature of possible disruptions, their size, frequency, duration and probability play a critical role in determining the optimum or "sufficient" size of the SPR. It was the judgment of the interagency SPR size study working group that, given the economic and statistical analyses, assumptions used, and multiple sensitivity case analyses, the current SPR size of 580 million barrels and its planned size of 750 million barrels provides an effective response measure capable of offsetting the effects of a severe interruption of petroleum supplies. When all offsets, including coordinated stockdraw are considered, disruptions several times larger than those that occurred in the 1970's can be mitigated.

The Analysis of Size Options assessed the quantifiable economic costs and benefits, as well as strategic factors such as foreign policy flexibility, associated with two SPR size increments: 600 to 750 million barrels and 750 million barrels to one billion barrels. It is not feasible to estimate a "minimum" SPR level based on this analysis, or to apply the methodology and assumptions of the recent study to examination of SPR size below 600 million barrels.

Allied Stockbuild

Question: What can be done to encourage our allies to build more substantial strategic stocks?

Answer: Over the years, the U.S. has continued to stress to its IEA partners the need to maintain high levels of strategic stocks, and the economic benefits of releasing stocks early in a disruption, and in large volumes. Virtually all IEA members now agree that stock drawdown should be the first line of defense in a disruption, which is in contrast to their previously held position that the use of stocks was a measure of last resort. Further, several key IEA economies, notably Germany, Japan and the Netherlands, have established government controlled stockpiles, thus ensuring that these volumes are fully available for use in an emergency. The U.S. will continue its efforts to encourage its IEA partners to increase their emergency reserves, through both bilateral contacts and in meetings of the IEA.

Restrictions on Development of Domestic Resources

Question: The U.S. Minerals Management Service director announced DOI's strategy in developing the next 5-year Offshore

Continental Shelf Leasing Plan. They will offer less acreage, schedule fewer sales, and pay more attention to environmental concerns. They are postponing the release of the plan until the President decides on the fate of three sales and the DOE issues its initial National Energy Strategy.

What impact on national security do you predict from the continued restrictions being placed on development of domestic energy resources?

Answer: The development of adequate supplies of competitively priced energy is an objective that has preoccupied this Nation since the energy crisis years of the 1970's. The Department is currently developing an integrated National Energy Strategy (NES) that will serve as a road map essential to reconciling our Nation's need for secure, competitively priced supplies of energy with environment, safety and health requirements. One of the goals of the NES is to develop a consensus to balance competing objectives, such as the impact of environmental concerns on the development of domestic energy resources.

It is clear that the increasing restrictions being placed on development of domestic energy resources will have an impact on our Nation's energy security. It is also essential that all offshore exploration and production be conducted only in an environmentally sound manner. The questions that the NES will attempt to address include how much of an impact on energy security do these continued restrictions have, how do we balance these competing needs, what are our options and what policies should we recommend to the President.

It should be noted that continued restrictions on offshore development may actually increase the risks to our environment. These restrictions may have the effect of increasing our oil imports and thereby will increase tanker traffic and the risks of oil spills. The risks to the environment from increased tanker traffic are significantly greater than the risks to the environment from the careful development of our offshore areas.

National Energy Strategy

Question: How have you participated in the development of DOE's National Energy Strategy?

Answer: The Office of International Affairs and Energy Emergencies (IE) has been an active participant in the National Energy Strategy (NES) process. IE is represented on the NES Development Committee which meets frequently to exchange ideas and information, and to receive guidance in preparing various components of the NES. Because the Office's responsibility cuts across all forms of energy and its usage, IE's participation in the NES has been wide ranging, including involvement in a number of the public hearings which addressed international and emergency preparedness issues. Admiral Watkins has stressed that the NES must be considered within the global context to be an effective strategy. Energy security is critical to the NES. IE staff members have provided substantial input within the NES process on the energy security issue and will continue to do so as the process continues in the coming months.

Question: What preliminary policy recommendations, based on the hearings that were held in the effort to develop the strategy, can you offer to assist agencies such as DOI in their ongoing efforts to manage national energy resources?

Answer: The National Energy Strategy (NES) Interim Report was published on April 2, 1990. The Interim Report is not a draft strategy and does not contain any policy recommendations. The Interim Report is a compilation of the comments from the public hearings and written submissions on a wide spectrum of energy issues including access to Federal lands and other resource management issues. During the remainder of 1990 the NES process is expected to foster considerable public debate regarding managing national energy resources. The NES goal is to provide a final report including policy recommendations to the President in December, 1990.

Tests and Exercises

Question: DOE's new director of Energy Emergencies stated concern is to move forward on administration policies that will make the U.S. less vulnerable to outside political pressures and increase secure access to an independent energy supply. The department will conduct a test this week in New Hampshire of its state and industry consultation and communication system. Several additional tests are planned in different parts of the country.

How do such tests help us when energy demand is increasing, oil imports are increasing, there is tremendous pressure not to drill offshore, not to have more nuclear power plants, and not to burn more coal because of acid rain?

Answer: The exercise conducted in New Hampshire was not limited to testing DOE's state and industry consultation and communication system. As part of the Office of Energy Emergencies' State Liaison Program, four regional seminars are being held across the nation to enhance Federal/state/industry cooperation. A region-specific energy emergency scenario has been developed for each seminar so that state energy officials, industry representatives and DOE personnel have the opportunity to simulate their responsibilities and response plans for an emergency situation that might occur in that region. The simulation for New Hampshire concerned a widespread electric power disruption, and gave the opportunity for the key state, industry and Federal players to test their response plans.

These tests, which are a part of the Office of Energy Emergencies' broader test and exercise program, become increasingly important as energy supplies become tighter because of growing energy demand and the obstacles which additional energy production faces. The tests and exercises ensure that emergency plans are operable and that the people involved in executing the plans have a clear understanding of their roles and responsibilities. Equally important is the process of team building, not only at the national level, but also at the regional, state and local level, so that the key players have had the opportunity to work together in advance of an emergency.

Northeast Regional Electric Power Capacity

Question: The Director is concerned with electrical generation shortages which are predicted in the Northeast region. What is being done to determine how the margins of excess power capacity can be increased?

Answer: The margin of generating capacity over peak demand can be increased by supply side or demand side methods or a combination of the two. However, it must be recognized at the outset that maintaining an adequate electric power supply in a given locality is the responsibility of the local utility and the state Public Service Commission. The Department of Energy has an interest in these matters from the perspective of national energy policy, but it has little direct authority.

The Department has several activities which we think help to ensure the adequacy of electricity supplies. To call the public's attention to this issue, senior officials frequently stress the critical importance of adequate electricity supplies to the Nation's economic health and to the quality of life Americans now enjoy. For example, the Department has spoken out strongly against the decision of New York State officials to dismantle the fully-licensed and ready to operate Shoreham nuclear power plant. The Department views this action as inconsistent with sound energy, environmental and economic policy. It will clearly exacerbate the energy reliability situation on Long Island and in the Northeast. On the other hand, the licensing and safe start up of the Seabrook nuclear power plant will improve substantially the electricity generation situation in New England. While the Seabrook licensing had faced numerous delays which significantly increased the costs of the plant, the plant was granted a full-power license in early March by the Nuclear Regulatory Commission after an extensive analysis of the plant's safety. The safe operation of Seabrook will provide much-needed electricity to the region, and will help protect the environment by generating electricity without emitting possible "greenhouse" gases or acid rain precursors.

The Department has a major program in least-coast utility planning, which is intended to aid utilities and their regulators in the development of economically efficient conservation and load management programs, and thus to reduce the amount of new capacity needed. The Department also sponsors research and development of pollution reducing methods for burning coal in utility boilers; this will allow greater use of coal-fired generating capacity. In addition DOE is funding the development of less costly and inherently safer technology for utilizing nuclear power for electric generation.

On the supply side, we support the development by utilities and states of procedures for the competitive procurement of new generation capacity. In recent years, these approaches have shown much promise as means of bringing on new capacity efficiently and quickly. We publicize the need to review maintenance procedures so as to increase the availability of existing generating capacity. In the Northeast in particular, there is great interest in the use of natural gas for generation, but the development of new gas-fired generation is hindered by a shortage of pipeline capacity for delivering gas to the region. The Department supports prompt resolution of the various institutional obstacles to bringing new pipeline capacity into operation.

Finally, we support the efforts under way in various states to determine whether the traditional regulatory process needs to be modified in order to give utilities appropriate incentives to move forward with investments in new generating capacity and demand-side management. We also support new approaches to the use of the transmission system that will allow greater efficiency and flexibility in the use of existing generating capacity.

TUESDAY, MARCH 20, 1990.

ENERGY INFORMATION ADMINISTRATION

WITNESSES

HELMUT A. MERKLEIN, ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION

LAWRENCE A. PETTIS, DEPUTY ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION

JOHN COOK, DIRECTOR, PETROLEUM MARKETING DIVISION, ENERGY INFORMATION ADMINISTRATION

OPENING REMARKS

Mr. ATKINS. All right. If you could bring whomever you need, and if they could just identify themselves for the record once again. Your complete statement will be entered into the record.

[The biographies and the statement of Mr. Merklein follow:]

U.S. Department of Energy
Assistant Secretary for
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BIOGRAPHY

LAWRENCE A. PETTIS

Lawrence A. Pettis is the Deputy Administrator, Energy Information Administration within the U.S. Department of Energy. In this position, he is responsible for the day-to-day management of the organization serving as the U.S. Government's primary source of comprehensive national energy statistics and objective energy analysis.

Prior to joining the Energy Information Administration in 1985, Mr. Pettis served as the Associate Deputy Assistant Secretary for the Strategic Petroleum Reserve (SPR) in the Department's Office of Fossil Energy. In his nine years with the SPR program, he held various management positions with responsibility for program planning, design/construction management, crude oil acquisition and transportation, and emergency preparedness activities.

From 1969 to 1976, Mr. Pettis was employed by the U.S. Department of the Navy in project management/engineering positions associated with the nuclear submarine program.

Mr. Pettis was born on May 21, 1946, in Oklahoma City, Oklahoma. He received his B.S. degree in mechanical engineering from Oklahoma State University in 1969. He has also completed graduate courses in engineering administration at George Washington University.

April 1987

BIOGRAPHY

John S. Cook
Director
Petroleum Marketing Division
Office of Oil and Gas
Energy Information Administration
Department of Energy

John S. Cook has served as the Director of the Petroleum Marketing Division, Office of Oil and Gas, Energy Information Administration (EIA), since November 1981. His responsibilities include technical management of analysis, production, and program development activities related to the publication of crude oil and petroleum product price and distribution information.

Dr. Cook received a Bachelor of Arts degree in mathematics from Southern Illinois University in 1966; he obtained a Master of Science degree in mathematics at Purdue University in 1968, prior to graduation in 1974 with a Ph.D. in economics.

In August 1972, Dr. Cook joined the faculty of the University of South Carolina, where, as an Assistant Professor of Economics, he taught graduate and undergraduate courses in economics, statistics, and mathematics, and directed graduate research in mathematical economics. While serving in this capacity, Dr. Cook wrote his doctoral dissertation and several articles, which were delivered at academic conferences and published in professional journals.

In August 1975, Dr. Cook accepted an economist position with the Bureau of Labor Statistics (BLS), where he was responsible for identifying major inconsistencies in the conceptual foundations of the Bureau's interarea cost of living indexes. After proposing alternative measures, he was promoted in January 1978 to the position of Chief, Branch of Service Industry Price Indexes, in which he managed publication activities related to transportation price indexes. He was also responsible for expanding the scope and foundations of the services program to include the communication and insurance sectors.

In April 1980, Dr. Cook joined EIA's staff as Director of the Petroleum Marketing and Pricing Statistics Division, where he managed publication and statistical development activities connected with petroleum product prices and marketing. Following EIA's reorganization in July 1981, Dr. Cook served as an assistant to the Director of the Petroleum Marketing Division, in which capacity, he was responsible for designing and implementing EIA's current petroleum pricing program.

Dr. Cook has received numerous scholarships and assistantships; he has been cited for outstanding teacher awards and received a Krannert Research Grant in 1972. His program contributions have been acknowledged as outstanding at BLS and EIA.

Dr. Cook is married and has two children.

Statement of Helmut A. Merklein
Administrator, Energy Information Administration
Department of Energy
Before the
Committee on Appropriations
Subcommittee on Interior and Related Agencies

Mr. Chairman, I am pleased to appear before this Committee today to present the Fiscal Year 1991 budget request of the Energy Information Administration, or EIA. This request is for $66.6 million and 468 full-time equivalent staff years (FTE's). I consider this amount to be reasonable to continue EIA's basic mission in FY 1991.

MISSION OF THE ENERGY INFORMATION ADMINISTRATION

The EIA is the Nation's primary source of comprehensive energy information. EIA provides relevant and timely energy statistics and analysis reports to the Executive Branch, Congress, State governments, industry, and the public so that those who make decisions about energy do so with adequate information at their disposal. EIA also provides, on a reimbursable basis, energy data, analyses, and data processing support to the Federal Energy Regulatory Commission and other Department of Energy (DOE) offices to assist them in carrying out their responsibilities.

In accordance with its legislative mandate, EIA collects, evaluates, assembles, analyzes, and disseminates data and information that are pertinent to energy resources and reserves; energy production, consumption, distribution and technology; related economic and statistical information; and data and information that bear upon the adequacy of energy resources to meet this Nation's demands in the near- and longer-term future.

While administratively an integral part of the Department of Energy, EIA is vested with a considerable measure of autonomy in determining both the information to be gathered and the content of EIA reports. EIA was established by Congress as an unbiased source of energy information and analysis. Subjects of interest to Congress, which we have recently addressed, include shortages and price increases for heating oil and propane and the acid rain provisions of the proposed Clean Air Act legislation.

USES OF ENERGY INFORMATION ADMINISTRATION PRODUCTS

EIA products are a recognized and integral component of the Federal statistics program as illustrated by the following uses. The Bureau of Economic Analysis uses EIA's petroleum data for the Gross National Product accounts. The Bureau of Labor Statistics uses our energy price and consumption data to verify the Producer Price Indexes, Consumer Price Index, and to calculate foreign crude oil price indices. EIA data on coal, electric power, and petroleum are routinely used by the Environmental Protection Agency for developing both area emissions estimates and new source performance standards. Further, the EIA-767, "Steam-Electric Plant Operation and Design Report," which collects environmental data from electric utilities, has been cited in the President's proposed amendments to the Clean Air Act as the source for fuel data. This form is jointly sponsored by 5 organizations in 3 Federal agencies.

The Nuclear Energy Agency of the Organization for Economic Cooperation and Development relies on EIA for historical data and projections of nuclear electricity generation, associated nuclear fuel cycle requirements, and estimates of uranium resources. The Office of Civilian Radioactive Waste Management uses EIA data and projections of nuclear electricity generation, nuclear waste fees, and nuclear spent fuel discharges in planning and conducting the Nation's waste storage program. The International Energy Agency uses EIA's information and analyses on energy sources as the official statistics to describe the U.S. energy situation in international forums and publications.

The Federal Energy Regulatory Commission uses EIA data and analyses in conducting their statutory functions. The Commercial Buildings Energy Consumption Survey serves as a data collection vehicle for the Environmental Protection Agency, gathering data on asbestos related items in commercial buildings, and for the Bureau of the Census, obtaining information on expenditures for building alterations and repairs. And finally, EIA is also a major source of energy information for the media, such as, Forbes, Business Week, New York Times, Reuters News Services, and national and local radio and television networks.

FISCAL YEAR 1990 ACTIVITIES

During FY 1990, EIA is providing analytical support to the Department in its development of a National Energy Strategy. This Strategy is meant to provide clear signals to decision-makers in the public and private sectors that reconcile our Nation's need for secure, competitively priced supplies of energy with environment, safety, and health requirements. EIA specifically has been asked to develop a National Energy Modeling System (NEMS) to assist in analyzing issues and alternative policies. NEMS is being built upon EIA's existing inventory of analytical models and may include linkages to other models within and outside the Department.

Areas identified for improvement in the modeling capability over time include estimating environmental emissions, considering the effect of new technologies on demand and supply potential, estimating fuel cycle costs, improving energy demand and renewable energy data collection and analysis, and extending forecasts beyond 2010.

In addition, EIA is continuing to produce and provide a stable core of publications and analysis reports. These include major multifuel publications, such as the *Monthly Energy Review*, the *Annual Energy Review*, the *International Energy Annual*, the *Annual Energy Outlook*, the *International Energy Outlook*, and the *Short-Term Energy Outlook*. Also included are the major fuel-specific publications, such as the *Electric Power Monthly*, the *Natural Gas Monthly*, the *Petroleum Supply Monthly*, and the *Petroleum Marketing Monthly*. EIA will also produce the *Crude Oil, Natural Gas Liquids, and Natural Gas Reserves Annual Report*, the *Weekly Petroleum Status Report*, and other weekly, monthly, quarterly, and annual reports. In addition, the Residential Energy Consumption Survey will be conducted during FY 1990.

EIA will continue to provide basic energy information support to the Federal Energy Regulatory Commission on a reimbursable basis to assist them in meeting the needs of their regulatory functions. EIA will also provide reimbursable support to other Government offices, such as the Office of Civilian Radioactive Waste Management, the Strategic Petroleum Reserve Office, and the Family Support Administration. Finally, EIA will continue to manage the DOE energy information forms clearance program and prepare the annual DOE Energy Information Collection Budget.

FISCAL YEAR 1991 OBJECTIVES

EIA will continue to collect, process, interpret, and disseminate reliable energy information. To accomplish our mission, the FY 1991 Budget requests funds of $66.6 million, with no significant program changes from FY 1990. However, directional changes may be appropriate as a result of the development and implementation of the National Energy Strategy. Increases are provided to restore funds to activities reduced by the FY 1990 sequestration, to account for a 3.3 percent inflation factor, and to fund the FY 1990 pay increase. The completion of the improvement projects for the International Energy Questionnaire and the Transportation and Refining of International Petroleum Model resulted in reduced funding needs of $252,000. A reduction of $520,000 in the triennial energy consumption surveys reflects the fact that the regularly scheduled surveys planned for FY 1991 are less costly than the Residential Energy Consumption Survey that was conducted in FY 1990. Finally, a decrease of $409,000 is reflected in administrative costs due to planned efficiencies in operations and reduced overhead rates. As in FY 1990, a significant portion of EIA's modeling and analysis agenda will be directed towards supporting the National Energy Strategy.

NATIONAL ENERGY INFORMATION SYSTEM

The National Energy Information System (NEIS) contains the operational elements of EIA. They are: the Oil and Gas Program; the Coal, Nuclear, Electric, and Alternate Fuels Program; the Energy Markets and End Use Program; ADP Services; Information Services; and our Statistical Standards Program. The request for NEIS is $56.7 million and 435 FTE's, which includes 14 FTE's reimbursed by the Federal Energy Regulatory Commission and two FTE's funded by the Office of Civilian Radioactive Waste Management.

The budget request for the Oil and Gas Program is $14.1 million and will allow EIA to continue at the FY 1990 level to provide analyses and information on petroleum and natural gas reserves, production, supplies, and markets.

The FY 1991 budget request for the Coal, Nuclear, Electric, and Alternate Fuels Program is $5.5 million. This reflects a program decrease of $20,000 due to the elimination of the publication, Nuclear Power Construction Activity. There were no other program changes.

The Energy Markets and End Use Program has a proposed FY 1991 funding level of $4.8 million compared with $5.2 million in FY 1990. This program change is primarily due to the fact that the Manufacturing Energy Consumption Survey, the Residential Transportation Energy Consumption Survey, and the sampling frame update for the FY 1992 Commercial Buildings Energy Consumption Survey are less costly to implement than the Residential Energy Consumption Survey conducted in FY 1990.

Funding for the ADP Services Program in FY 1991 is requested at $7.3 million, which will provide for the continued operation and maintenance of our ADP facility.

The Information Services Program, which contains the National Energy Information Center, our public information window to the world, has a proposed FY 1991 funding level of $0.7 million.

The Statistical Standards Program is responsible for assuring the overall statistical quality of EIA's information products and operating the forms clearance and burden control program. The FY 1991 budget request for this program is $1.2 million.

POLICY AND MANAGEMENT

Policy and Management provides the resources necessary for the central management, guidance, and coordination of all EIA activities, such as planning, budgeting, contract management, and other administrative functions and services. The FY 1991 proposal of $9.9 million and 31 FTE's includes a decrease of $409,000 after inflation. This decrease is attributable to planned and continued efforts to lower administrative overhead costs in order to free up funds for core program efforts.

I will be glad to answer any questions the Committee may have.

Mr. **Pettis**. I'm Lawrence Pettis. I'm the Deputy Administrator of the Energy Information Administration.

Dr. **Cook**. John Cook, the Director of the Petroleum Marketing Division for EIA.

Dr. **Merklein**. I'm Helmut Merklein, the Administrator of EIA.

NATIONAL ENERGY STRATEGY

Mr. **Atkins**. If I could talk a little bit about the National Energy Strategy. Dr. Merklein, if you could explain the role of EIA in the development of the National Energy Strategy.

Dr. **Merklein**. We have served essentially as a primary database and as modeling experts to the Secretary's National Energy Strategy effort. Some of the things are new to us that we are beginning to touch on, and we will get into it in some more detail.

Our energy renewables—there is more emphasis on energy demand and conservation potential. We have dealt with environmental emergencies, in particular. There is concern about total fuel cycle costs as opposed to the information we have collected in the past, which is only actual expenditures in conjunction with the burning of fuels. We have extended, this year, our Annual Energy Outlook to the year 2010 from last year's 2000, and we have provided some help in going even beyond that to the year 2030.

Another area of increased emphasis is the assessment of emerging technologies, particularly in the long-run projections. We have absorbed, essentially, the additional costs involved by reordering our own priorities. The funding for self-initiated analysis and modeling that is being directed toward the NES—the National Energy Strategy—is on the order of $600,000 or so.

Some other offices has chipped in to some extent. The Policy Office, for example, and the program offices have provided us with another $300,000 to help take the financial strain off of us. So it has been a mixture of reordering our priorities, and frankly, begging for help from our sister organizations. We survived it, and with the current budget that we have, we intend to continue for fiscal year 1991. We will probably be hurt in terms of specific allocations when we have muddled through all of this and have distilled out what it is that we really want. Right now, we vaguely want certain data in certain areas, but it takes some digging to define that closely.

ACCURACY OF FORECASTS

Mr. **Atkins**. Given the level of resources you have, and the level of resources requested by the President for you, will your forecast be significantly more accurate or comprehensive than those that are provided now?

Dr. **Merklein**. Well, let's talk accuracy. The only place where you can gauge accuracy really is on the Short-Term Energy Outlooks. There we have done reasonably well, I think, although I understand some people hold different views, except in the area of pricing, that is crude oil price, oil prices. We did not anticipate—but then I don't know anyone else who did, for example—the price collapse of 1986. We had a hard time with the second-year price collapse of 1988.

Because those movements are brought on by capricious supply decisions by parties that we do not control and that do not seem able to control themselves, it is very difficult to come to grips with prices. In the long run, I don't know how accurate we really are. We will move out into other areas, as I said, in terms of information gathering and historical gathering, which will allow us to make some statements into the future that we have not covered before. I mentioned some before, conservation, fuel costs, assessment, and so on.

DISCRETIONARY PROGRAMS

Mr. ATKINS. In a memorandum of December 20, 1989, from the Secretary to you, he asked for a review of your discretionary programs. How much of your program do you consider discretionary? Can you tell us what that consists of?

Dr. MERKLEIN. I would like to turn to our Deputy Administrator on that one. I don't, off hand, remember what it was. If he doesn't either, then we'll submit it for the record.

Mr. PETTIS. Well, primarily, the area of some option in EIA is what we call "analysis." Most of our data collections we feel are required to cover our core obligations to provide data. We have a budget of about $11 million in the analysis area, and we have gone through a process of trying to identify which portions of that budget are related to specific mandatory requirements.

Mr. ATKINS. I have a number of other questions that are more technical in nature. We'll give you those questions. If you could submit the answers for the record, we'd appreciate it.

U.S. CRUDE OIL PRODUCTION

Mr. ATKINS. You, Dr. Merklein, in your annual report to the Congress, with the Administrator's message, said, and I quote, "It is not EIA's place to make policy recommendations. Certainly this message is not intended to give policy advice. However, for the first time in five years as Administrator of EIA, I am raising my voice of concern that crude oil production is currently in greater jeopardy than it has ever been before." Could you elaborate on that a little bit and share some of your concerns with this committee?

Dr. MERKLEIN. I'd like to, and if time does not permit, I wrote some thoughts out along those lines, and then we might submit it for the record. Briefly, what it says is this: We lost 550,000 barrels last year alone. Of course, that compares to a current production rate of approximately 7½ million barrels. In the Administrator's message that you have in front of you, I have pointed to the declining crude oil production in the various regions, and you will see that it has been running anywhere from 20 percent to 33 percent or so between 1986 and the current point in time, with the exception of the Arctic North Slope.

On the North Slope, the total decline has been only 9 percent, but that is because the Prudhoe Bay area has been producing at capacity. By that I mean, pipeline through-put capacity, up until March 1988. Production is declining now. In the North Slope arena, the largest field is the Sadlerochit reservoir, which produces three-quarters of the total two million barrels per day, and it is expected to be declining at something like 10 or 12 percent per year.

We, in our own forecast, the Annual Energy Outlook of 1990, have anticipated a reduction of about 2.4 percent per year in our production between now and the year 2010. That would leave us in the year 2010 with something on the order of 4.8 million barrels compared to the 7.5 or 7.6 million barrels today. It could very well be that we lose control of our ability to govern the decline rate.

What I am worried about is environmental problems that increasingly interfere with our ability to produce. In the North Slope area, the no net loss of wetlands problem may very well translate itself in very high mitigation costs that may make marginal fields of questionable commercial value.

We also have off-shore problems. For example, in California, we have the Point Arguello field, which has been completed for some time now and is not permitted to come on stream. I compare it in some ways to the nuclear situation where we permit the building of productive facilities, but then we do not permit the placing on stream of these facilities except, of course, that in crude oil production there is no such thing as a regulatory rate base where you can pass on those losses. Those losses, which amount collectively to about $800 to $900 million last year alone, are simply permanent losses to the oil companies concerned.

A lot of people have observed that oil companies, particularly the major ones with financial muscle, increasingly go overseas. The reason for that is that there is a level world oil price, essentially everywhere, but if in this country we raise the cost of production, then the margin will be more attractive abroad. If we don't watch out, those higher costs will, or might, bring on the same dilemma we had back in the olden days of natural gas price control when, you will remember, we had very expensive high-cost gas being sold at about five times the market price and low-cost gas, which on the normal market ordering procedures might have come on, would have never been produced. Of course, the Congress, the Administration, the country at large, have begun to understand the problem, and the natural gas regulatory problem no longer exists. By 1991, the market essentially will dictate the prices.

There is a similar proposition I see emerging as a potential threat. I'm not saying it's a threat today. The potential threat is that we will leave, what in retrospect will look like low-cost oil, behind, but we might never get to it again in remote places like the Arctic, simply because we have raised the production costs in this country.

The difference, for example, between our projected business as usual 2.4 percent decline rate and a not unreasonable 5 percent decline rate, if you remember that the normal decline rate in fields generally is on the order of 10 percent, assumes replacing half of the production with new-found reserves between now and the year 2010. That difference makes a difference in total production of about two million barrels per day. If the decline rate were 5 percent, not unreasonable and not what we are now projecting, then we would no longer be producing 4.6 or 4.7 million barrels per day by the year 2010, but 2.6 million barrels per day. We would be essentially through as a major producer in the world.

In the meantime, those two million barrels we lost by way of domestic production would have to be acquired in world markets, therefore raising the market participation of the OPEC countries, and their market power, and giving them more leverage to raise prices which we will all have to share. That is sort of the idea I had in trying to raise the level of national consciousness to this ongoing problem.

Mr. **Atkins**. Do you have that statement in more detail written out?

Dr. **Merklein**. Yes, sir. I do.

Mr. **Atkins**. If you could provide that for the record——

Dr. **Merklein**. I'd be happy to.

Mr. **Atkins**. I presume, together with that, you have some recommended policy changes to correct the problem?

Dr. **Merklein**. Well, I did not provide policy changes because I'm still wearing the cap of the Administrator, but if you would like for me to, and if the Congress of the United States will bear with me for the remaining six or so weeks, assuming suddenly a policy role, I would not mind adding on some views of how this may be resolved.

Mr. **Atkins**. We'd be delighted to, if you could. You can do it as you take your hat off. Put them in your hat and submit it—pull them out of your hatband for us. That would be very helpful.

[The information follows:]

U.S. CRUDE OIL PRODUCTION IN CRISIS - A PERSONAL VIEW

Having been at the helm of this Nation's energy data collection and analysis center for nearly five and a half years, longer than any EIA Administrator before me, I appreciate the opportunity to speak out on an issue that merits a moment of careful attention by energy policy makers. I particularly appreciate this invitation, as a parting gesture, to stray from the strictly statistical realm. The views I am about to express are entirely mine; they do not reflect an official EIA or Administration position.

In EIA's 1989 Annual Report to Congress, I devoted the Administrator's message to a single issue: the dramatic decline of U.S. crude oil production. I pointed out that last year alone, domestic production dropped by roughly half a million barrels per day, leaving us with an end-of-year production rate of 7.5 million bbl/d. This compares to an all-time high of 9.6 million bbl/d (1970), and to 9.2 million bbl/d a mere 4 years ago.

I showed just how pervasive the decline in U.S. crude oil production is by presenting in tabular form the productive capacity lost since 1986 in various producing regions:

550,000 bbl/d	or 23%	in Texas
290,000 bbl/d	or 29%	Offshore in the Gulf
210,000 bbl/d	or 19%	in California
190,000 bbl/d	or 9%	in Alaska (from its 1988 peak)
160,000 bbl/d	or 34%	in Oklahoma
110,000 bbl/d	or 21%	in Louisiana
70,000 bbl/d	or 19%	in Wyoming
70,000 bbl/d	or 32%	in Kansas
40,000 bbl/d	or 18%	in New Mexico
40,000 bbl/d	or 33%	in Utah
30,000 bbl/d	or 23%	in North Dakota

Current EIA projections, contained in the 1990 Annual Energy Outlook, anticipate future production declines of 2.4 percent per year under normal circumstances, i.e., with the underlying assumption that the existing regulatory regime and concomitant incentive structure remain unchanged. But will they remain unchanged?

The regulatory regime and the incentive structure are changing before our very eyes, and the results are plain to see: the U.S. rig count is seemingly unable to recover from its by now chronic low, the number of active seismic crews is at its lowest point since we started counting, and the major oil companies are increasingly re-allocating their exploratory budgets to foreign ventures. Based on published EIA data, domestic capital and exploratory expenditures of five major oil companies declined by 30 percent in 1989, compared to a 46 percent increase in foreign expenditures over the same period.

To some considerable extent, the reason for the withdrawal of oil capital from this capitalist nation par excellence is to be found in our environmental zeal. We are slowly but surely turning annual moratoria on off-shore drilling into permanent injunctions, even though off-shore drilling and production, as the President himself has recently observed, are unrelated to shipping in tankers, where most recent spills, and certainly the massive ones, have occurred. Indeed, as has been mentioned by others, by not drilling up domestic prospects, we are accelerating the decline of U.S. production and boosting future imports, using more and more tankers and thereby intensifying our risk exposure to pollution.

Perhaps the most damaging event of recent vintage is our refusal to permit a fully developed off-shore field, Point Arguello, to start up production operations. Chevron Corporation took a $445-million write-down on this venture, compared to a write-down by Phillips Petroleum in the amount of $280 million and to Texaco's write-down of $164 million (which includes a provision for reserves for future environmental liabilities). This sequence of events, new to the oil industry, is vaguely reminiscent of the nuclear industry, where we permit the construction of productive facilities, but prohibit their operation, except that there is no regulatory rate base in crude oil production to ultimately pass on the cost. It does not take too many Point Arguello's to convince the oil producers to seek their fortunes elsewhere.

Regulatory zeal in oil production, a relatively mild environmental activity, has probably been more pronounced in the Arctic than elsewhere in recent history, except of course in the Pacific off-shore region. The Prudhoe Bay area has so far produced in excess of seven billion barrels of crude oil, with roughly another six billion barrels to go, and probably considerably more, if the regulatory regime permits it.

There is justified doubt whether it will. Regulatory barriers have been erected and are still invoked to "protect" the caribou herd, even though it has clearly prospered. The herd is about triple the size it was when oil was first discovered at Prudhoe Bay.

The protection of fish involves another set of regulatory barriers at Prudhoe Bay, even though there is absolutely no scientific evidence that fish life has been damaged by Arctic off-shore operations. In fact, the regulators' own scientists seem somewhat perplexed by this. In a recent study they pointed to the difficulties in designing environmental regulations in the absence of hard scientific data and they noted that, in those cases where a regulatory regime is largely based on scientific speculation, that fact should be prominently stated ("fully explained and documented"). In the meantime, North Slope producers are required to spend several million dollars per year on fish studies of questionable validity.

The emergence of a policy of no net loss of wetlands has provided unlimited opportunities for indiscriminate regulation. True, the President has endorsed the concept. Indeed, there is much to be said in its support: we have lost more than half of our original wetlands already, and the rate of further losses is alarming. Yet, while the concept is sound, the regulatory implementation is flawed. For example, there is no distinction in regulatory treatment between temporary conversions, such as wildcat wells that have an 80 to 90% chance of being abandoned and reconverted to the original state within months, and long-term conversions as they would typically occur in agriculture or in urban encroachment.

Newly discovered oil and gas fields fall between these two extremes. They can be expected to last 10 to 20 years but, clearly, after they have been exhausted, the land on which they are located is likely to, in fact can be required to, revert to its original status. Instead, under the current no net loss of wetlands regime, wetlands of equal or greater size have to be created up front, with the additional stipulation that, upon abandonment, the field's surface be reconverted. That means, of course, that at least two acres of wetlands are ultimately created for every acre of wetlands supporting oil and gas operations, at a cost.

The blanket application of a no net loss of wetlands regime is particularly troublesome in the Arctic, where the absence of ground water (the water is frozen to depths of up to 2000 feet, hence there is only ground ice) and the fact that practically all flat land has been defined as wetlands make wetland creation a physical impossibility. And yet, it is the Arctic that currently produces some 25 percent of our domestic oil production, and it is the Arctic that holds considerable promise for undiscovered giant fields.

Another area of some concern is our National Forests, where the U.S. Dept. of Agriculture, a relative newcomer to oil and gas production, is currently in the process of devising a regulatory regime. Depending on the structure of that regime, oil and gas exploration and production may be encouraged or discouraged. It is too early to tell which way the system is leaning.

Of course, the decline of domestic oil production is ultimately inevitable, but we do have considerable control over the rate of decline. If we allow the 1988/89 decline rate of about five percent to become chronic in this country, our crude oil production in 2010 will be 2.6 million bbl/d, as opposed to the 4.8 million EIA is projecting under the business-as-usual scenario.

We will eventually have to come to grips with the national security issues that are implied, one way or another, in our declining domestic oil production, and we will have to learn to absorb the balance of trade losses that this entails. These and other questions are being addressed by Secretary Watkins' National Energy Strategy.

Where we lose out by artificially accelerating our energy dependency is in refusing to move into critical resources in accordance with market signals, i.e., at a time when buyers and sellers demand their development. More so than most industrial nations, we have the time to develop meaningful energy alternatives, but we are giving that time away. The result is an inefficient allocation of our resources, an inefficient economy at large, with reduced wealth for all.

We have seen in the natural gas markets what happens when the natural market ordering is disturbed: expensive gas, selling at five times concurrent market prices was being produced first, and low-cost gas was being left behind. An excessively stringent, and expensive, environmental regime has the same effect: what should have been relatively low-cost oil will be left behind, much of it never to be recovered. In the meantime, our claim on crude oil in world markets rises much faster than it needs to rise, raising OPEC's market share and market power in the process, and driving world oil prices higher than they would be otherwise.

This is not to be taken as a call for the exploitation of our resources, regardless of environmental consequences. I remember only too well the days of unlined reserve pits, of poorly controlled salt water disposal systems, of well heads or lubricators being bled onto the well site or, worse, into the waters of our coastal bays. Those days are long gone, probably never to return. What we need now is oil production personnel with a passion for the environment and environmental regulators with an understanding of our national energy needs, and a meeting of the minds of the two groups.

WETLANDS CONCEPT

Dr. **Merklein**. One area I touched on already, is the no net loss of wetlands concept, for example. There is no discriminatory or regulatory policy that takes into consideration the length that a given project is likely to take. For example, if you have urban encroachment or agricultural conversion of those wetlands into drylands, presumably this is forever. There is concern, and legitimately so.

If you have a wildcat, then the chances are 80 to 90 percent that that wildcat drilled in wetlands will turn up dry. Within months, you will know that there is no major claim on any lands of any kind, and it would appear that a no net loss of wetlands proposition would simply entail an obligation subsequent to the abandonment of the wildcat to turn it back into wetlands, as opposed to requiring the equivalent up-front conversion of other land into wetlands, and then subsequently adding on the wildcat surface area on top of that for a mere matter of two or three months, or whatever it takes to drill one of those wells. It is a minor thing in terms of surface area. It is a major thing in terms of exploratory costs.

Mr. **Atkins**. I would just tell you that I have strong differences with your view. I'd be fascinated to see your views. Just for the record, I have strong differences, having watched the enormous damage that has been in the Arctic around Prudhoe Bay. You can watch some of the seismic lines that were laid out decades ago, and you can still see the environmental damage that was caused on the tundra by the tires on the vehicles that laid out those lines. I have grave reservations about that, but I do look forward to seeing your views, no matter how much I may disagree with them.

Dr. **Merklein**. Can I get into those? These are old surveys, and there is general agreement that the tundra is very sensitive. That is why today seismic shots are made during the winter where there is no danger. For example, ANWR—the Arctic National Wildlife Refuge—has been surveyed twice now and it is not visible on the surface. There are ways to mitigate that we know today that we didn't know 20 years ago.

Mr. **Atkins**. And there will be ways to mitigate tomorrow that we didn't know today which would militate to holding that land in reserve and preserving it now until we really have the technologies to remove the oil with virtually no environmental damage.

Dr. **Merklein**. What you're saying is we never cease learning, and we can agree on that, yes, sir.

Mr. **Atkins**. Okay. On that note, just one point of agreement. We're through Dr. Merklein, with our questions for you. We have further questions but we'll submit those for the record. If you could provide a response to the record, I will be fascinated to see your views on the petroleum supply question.

[Questions and answers for the record follow:]

ADDITIONAL COMMITTEE QUESTIONS

National Energy Strategy (NES)

Question: Please explain your role in the development of the National Energy Strategy?

Answer: The Secretary of Energy has asked EIA to support the development of a National Energy Strategy. Because of its role as the independent data collection and analysis group within the Department, EIA was asked to develop a National Energy Modeling System (NEMS). The goal of the NEMS effort is to build a flexible modeling system that will encompass the Department's best capability for energy modeling. In addition, EIA is providing data and analytical support to the Department for the NES.

Question: Explain how you need to change your existing energy models to provide the new "National Energy Modeling System?"

Answer: EIA does not envision building a "new" National Energy Modeling System. Rather, EIA will build on its existing analytical models with a phased approach planned to achieve changes or improvements in our modeling capability over the next several years. In addition, other models both within the Department and outside will be identified and reviewed to determine if linkage to these models would enhance our analytical capabilities. Areas identified for improvement include estimating environmental emissions, considering the effects of new technologies on demand and supply potential, improving energy demand and renewable energy analysis, and extending forecasts beyond the year 2010.

Question: What specific data areas will be improved and what is the significance of these improvements?

Answer: Several major data areas are being explored for possible improvements. Expanded knowledge of the energy consuming characteristics of energy users, especially the industrial sector, and of the closely related topics of energy conservation technologies and demand management, is important when considering the potential for reducing energy use as an alternative to increasing energy supply. On the supply side, information on renewables and other alternatives to traditional fuel sources, as well as advanced supply technologies, has been difficult to obtain because these industries are so young. With increasing concerns, both in the U.S. and abroad, about the quality of the environment, a better understanding is needed of the constraints that hold back expanded production and use of energy. Analyses are currently underway exploring these areas. The need for expanded statistical survey activities in these areas is currently being reviewed in the context of resource availability and the requirements of the Paperwork Reduction Act.

Question: How long will it take to make these improvements?

Answer: It is anticipated that improvements to the NEMS system will be an evolving process. In the short-term, EIA has currently implemented a three-phased approach to achieve improvements in our modeling capabilities over the next several years. The scope and magnitude of the longer-term NEMS effort is being defined as the initial NES is being developed.

Question: Will forecasts be significantly more accurate or comprehensive than those provided for now? If so, in what respect?

Answer: Long-range forecasts by their nature involve considerable uncertainty. To address this uncertainty, EIA forecasts have typically been presented under a range of assumptions (i.e., economic growth, oil prices, etc.), and we have a rigorous program of documenting and making available to the public both the assumption and methodology used in the forecast. In spite of the underlying uncertainty, we continually seek ways of improving the accuracy of our forecasts and update our modeling systems accordingly.

In the NEMS development process, we are attempting to improve our understanding of how energy is used, and how new technology; alternative fuels; and other factors may impact supply and demand in the future. In addition, we are addressing environmental concerns which are currently of considerable interest. We would hope that these efforts result in forecasts that are both more accurate and comprehensive.

Question: What specific activities are you undertaking in 1990 or planning to undertake in 1991 in reference to both the NES and the model?

Answer: EIA has implemented a three-phased approach to the development of the National Energy Modeling System. Phase I, which is completed, identified and utilized existing EIA forecast modeling capabilities to develop a reference case for NES, extending its modeling systems forecasting capabilities to the year 2010. In Phase 2, which is currently underway, EIA is employing its existing modeling systems to explore the incremental impacts of alternative policies which the Department chooses to consider in the NES process. In Phase 3, enhancements of the NEMS system will likely entail some improvements to our modeling capabilities and the networking, or linkages, to other existing models that are found to be appropriate.

Question: What is the projected cost of these activities in each year?

Answer: Much of the NES effort has overlapped EIA's own analysis agenda since both are intended to address current and emerging energy issues. The Administrator of the Energy Information Administration is responsible for ensuring that the necessary steps are taken to keep abreast of the changing energy picture. Consequently, because of the overlapping nature, it is hard to specifically put a price tag on NES-related activities. However, it is estimated that approximately $1 million in contracts will be expended in FY 1990 and somewhat more than that in FY 1991 in analysis or modeling which will be supportive of NES. The need for additional resources will be determined as the need to support emerging analytical and data requirements are more fully defined. The impact of these requirements may be substantial particularly in the area of new end-use surveys to satisfy additional data requirements. We will assess the benefits and costs of pursuing these in more detail before spending more money on them.

Question: What other activities are not going to be carried out because of this work?

Answer: Very few. It is EIA's responsibility to stay in tune with the changing energy picture. Fortunately, to meet the NES-related requirements to date, only limited changes to EIA's analysis agenda have had to be made. Changes have been made either by postponing lower priority work or changing the focus of our analysis agenda to align with the NES requirements. EIA's core program remains unchanged.

Question: A memorandum of December 20, 1989, from the Secretary to you asks for a review of your "discretionary" program. How much of your program do you consider "discretionary" and of what does it consist?

Answer: A brief review of the Energy Information Administration's (EIA) legislative requirements is necessary before directly answering this question. Most of EIA's substantive requirements are found in the Federal Energy Administration Act and the Department of Energy Organization Act. The Administrator must collect, analyze, and publish reports that fulfill a mandate with specific deadlines (e.g., the uranium viability study, the Financial Reporting System, annual reports to Congress, and others). By those same Acts, he is also mandated to satisfy certain basic energy information needs whether they come from the Department, the Congress, other Government agencies, or the public. He is given the independence to determine what specific information is needed to "define and permit" analysis of the many aspects of the energy sector and to "provide a comprehensive picture" of the current and projected energy situation, "to the maximum extent practical subject to the resources available." Thus, the Administrator is mandated to carry out a program with some judgment, and can seek the advice of a broad range of users, one of whom is the Secretary of Energy.

Data collections have been established within the context of the need for energy information. Basic information on reserves, production, transportation, marketing, and use of energy has been required for quite some time and will continue to be required to keep people informed, with periodic adjustments for changes in the energy sectors.

More judgment can be exercised in the analysis area because the focus of EIA's analytical efforts is keyed to current events which change more rapidly over time. In FY 1990, a total of about $11 million in contract and staffing funds is directed to analysis. Of this amount, several of the reports (including the Annual Energy Outlook, Short-Term Energy Outlook, and the uranium viability assessment) totaling nearly $3 million, are explicitly required by law. About $6 million is required to maintain the modeling, forecasting, and analytical capability required by law to produce these and other reports (such as various fuel outlooks and EIA analysis reports addressing current issues). The remainder (about $2-2.5 million) is directed to special studies done at the request of Congressional Committees, other DOE offices and other agencies. Such studies include an analysis of the Clean Air Act being conducted for Representative Dingell, an analysis of increasing the size of the Strategic Petroleum Reserve requested by DOE's Office of Energy Emergencies, and efforts to support the Secretary's National Energy Strategy.

Question: Is this review currently underway?

Answer: EIA currently is in the process of devising a long-range plan (focusing on FY 1992), as a part of our normal planning cycle and to respond to a request from Under Secretary Tuck for long-term program proposals. Over the next few weeks, top EIA officials will discuss issues and establish priorities for FY 1992 that will also look back at FY 1991 to see whether any changes would be appropriate.

Question: When is it expected to be completed?

Answer: Initial input to the planning process will be completed by mid-April 1990 and will serve as a starting point for the FY 1992 budget development and review process.

Question: Do you expect it to involve major changes to your workload?

Answer: The review process is looking at emerging data and analytical needs, primarily in the areas of renewable energy sources, new technologies, and end-use consumption characteristics, which could involve changes in EIA's workload.

Question: The memorandum asks the review to assess changes in program to address "key" new responsibilities. What responsibilities are these?

Answer: From its inception, EIA was created to respond to the needs of the Department, Congress, and others within the resources available. Granted the focus of the analysis changes; new issues are examined; the players may be different; but EIA's responsibilities have not changed.

Question: The memorandum asks the review to address the changes in EIA's 1991 program as well as the 1990 levels. When do you expect to present these changes to Congress?

Answer: The need to support the development of the National Energy Strategy (NES) has set much of the EIA's analysis agenda for FY 1990 and is expected to do so in FY 1991 also. So far, changes have been accommodated within existing resource levels. The FY 1991 budget document on pages 524, 533, and 535, identifies realignments in FY 1990 and FY 1991 involving increased resources for energy end-use and alternative fuels information. Examples of specific NES-related analyses which have been undertaken this year include natural gas supply availability, penetration of advanced supply technologies in electric utilities, and the impact of the SO_2/NO_x emission reduction proposed in the Clean Air Act. Further changes in FY 1991 may be appropriate in light of the FY 1992 review currently underway. We, of course, would consult with the Committee in accordance with standard procedures prior to initiating any major shifts in resources from one area to another.

Other Emergency Data

Question: With regard to other emergencies, such as the Loma Prieta earthquake and Hurricane Hugo, what specific actions did EIA take?

Answer: Three EIA offices provided daily support to the Department's Energy Emergency Management Team (EEMT) efforts to respond to the 1989 natural disasters that hit islands in the Caribbean and South Carolina, and that struck California. Following both Hurricane Hugo and the Loma Prieta Earthquake, the Department's Energy Emergency Management System was activated, so that vital information and damage assessment reports were provided to the EEMT on the energy resources and infrastructures located in the affected areas. All three of EIA's major program offices-Oil and Gas; Coal, Nuclear, Electric and Alternate Fuels; and Energy Markets and End Use-were called into action. These offices also supplied situation analysis reports and monitored the repairs to energy-related systems.

EIA reported specific damage that occurred to petroleum, natural gas, and electrical resources. This included damage to facilities and distribution networks, estimates of energy supplies lost or delayed, the number of customers affected, and the time required to repair damage. EIA monitored the progress of repairs, provided situation updates to EEMT, and identified areas where the Department could offer assistance.

Especially useful for monitoring the progress of these natural disasters was the standby energy emergency analysis capability of EIA. The Office of Energy Markets and End Use utilized its Contingency Analysis Program to determine the extent of oil supplies lost or diverted and which petroleum products would be most affected. The

Office of Oil and Gas used its standby Energy Emergency Reporting System, which includes data on energy-related facilities, to produce maps and tables necessary to track the disaster and to prepare situation analysis reports for the Secretary of Energy. The Office of Coal, Nuclear, Electric, and Alternate Fuels provided technical expertise necessary to the EEMT for solving problems in the electric power area.

Question: What is your overall responsibility in this area?

Answer: EIA's overall responsibility in the emergency area is derived from its membership on the EEMT. As a member, the EIA has the responsibility to devote resources as deemed necessary by the EEMT to provide data, analyses, and other available technical expertise. As part of EIA's ongoing mission, the EIA devotes considerable resources to maintain data, models, and an expert staff at a high state of readiness to support the Department during emergency situations.

Question: How much did your responses require?

Answer: Approximately, six person months were devoted to the two disasters.

Replacement of Computer System

Question: The fiscal year 1990 (last year's) budget assumed beginning to upgrade your computer systems beginning in FY 1991 at a level of $7.5 to $10 million over five years. (1990 hearing: Part 3, p. 448-9). This year's budget delays the process a year until 1992 and estimates the cost at $2.8 million. Why are you delaying this process?

Answer: EIA's mainframe computer use growth rates have leveled off due to emphasis on communications networks, such as local area networks (LANs), and desktop capabilities, such as individual personal computer workstations. Because of this, EIA's existing mainframe computer system has sufficient capacity to satisfy EIA's requirements through FY 1991. In addition, EIA believes that its current software operating system technology will not need to be changed until FY 1992.

Question: What is the nature of the upgrade? Do you need additional capacity, more modern equipment, or both?

Answer: The upgraded mainframe computer system will have additional capacity (faster operating speed, more storage space, and additional channels), plus it will be more modern, with the capability to run the latest operating system software technology. At this time, the upgrade in operating system technology is at least as important as the additional capacity. The technology aspect is critical because it allows us to keep up with industry standards. We estimate that by FY 1992 the industry will not be adequately supporting the operating system software for the hardware configuration we now have. Technology upgrades also allow EIA to take advantage of state-of-the-art software which provides for better and faster data handling and more efficient computer operations. Without an operating system technology upgrade in FY 1992, EIA would be faced with increasing problems in maintenance support, as well as compatibility with our disaster recovery site and other Departmental sites.

Question: Are there risks involved in purchasing used equipment as you propose versus purchasing new equipment? (page 525)

Answer: The risks involved in purchasing used equipment are minimal. The used equipment will be completely cleaned and refurbished at a refurbishment center, and it will be certified for maintenance by the equipment manufacturer. The significant cost reduction of used equipment more than compensates for the minimal risks involved.

Electric Power Information

Question: In last year's hearing (pages 129 and 143) you indicated the need to gather more data on non-utility generation of power. At what stage are you in the data collection process? When do you expect to start?

Answer: The Energy Information Administration (EIA) Form EIA-867, "Annual Nonutility Power Producer Report," was submitted to the Office of Management and Budget (OMB) for clearance for a 3-year collection on September 22, 1989. The survey was approved by the OMB on December 22, 1989, for a 1-year collection except for the environmental data (Schedule IIIB). Schedule IIIB was modified and resubmitted to the OMB for approval. The modified form was approved by the OMB on January 19, 1990, for a 1-year collection period. The form was mailed to respondents on January 29, 1990, requesting its return on April 30, 1990.

Preliminary data from the survey for calendar year 1989 will be available December 1990. The EIA has begun the process of clearing the form for an additional 3-year period. The OMB has indicated that during the clearance period they will be reviewing the form for possible duplication with other Government collections.

Question: Demand side programs aimed at reducing energy use have begun a widespread basis. What plans do you have to collect "demand" side data from utilities?

Answer: Demand side management data are being collected for the 1989 reporting year on the Energy Information Administration (EIA) Form EIA-861, "Annual Electric Utility Report." This form is to be filed by all electric utilities in the United States by May 1, 1990. It will collect 1989 actual demand side management data and 10-year forecasts.

Question: What specific kinds of data do you expect to collect?

Answer: All electric utilities are asked the question: "Do you have utility-administered (demand side management) programs to reduce system load? Utilities over a threshold (120,000 megawatthours of sales to ultimate consumers or sales for resale) will need to provide:

- The actual reduction in peak load for the reporting year from all demand side management programs and from only direct load control programs.
- The maximum potential load reduction for the reporting year and for each of the next 10 years from all demand side management programs and from only direct load control programs.
- The energy savings for the reporting year and for each of the next 10 years from all demand side management programs.
- The capital expenditures for the reporting year and for each of the next 10 years from all demand side management programs.
- The annual expenses for the reporting year and for each of the next 10 years from all demand side management programs.

Question: Have you reviewed the need for data with the Conservation division in DOE which is active in supporting this area?

Answer: Yes. On August 14, 1989, the Conservation office requested that the Energy Information Administration (EIA) review a paper on "Comparison of EIA Data Collections: Electricity Supply and Demand," that indicated the need for demand side management (DSM) data. At that time, the EIA was clearing its electric power forms through the Office of Management and Budget (OMB) for a 3-year clearance period. It was determined that the best vehicle to collect the DSM data was through the EIA-861. That form was modified as discussed in the prior question. A memorandum from the Deputy Assistant Secretary for Conservation (dated September 5, 1989) justifying the need for these data was included in the OMB clearance package.

Reimbursable Obligations

Question: Please provide a breakdown of reimbursable obligations by organization for 1989, 1990, and 1991.

Answer: A breakdown of reimbursable obligations follows:

	FY 1989	FY 1990	FY 1991
	($ in	thousands)	
RECEIPTS AND REIMBURSEMENTS			
DEPARTMENT OF ENERGY:			
Federal Energy Regulatory Commission	$ 3,400	$ 3,200	$ 3,200
Strategic Petroleum Reserve	678	950	950
Policy, Planning and Analysis	170	100	100
Fossil Energy	63	100	100
Conservation and Renewable Energy	85	85	85
Hearings and Appeals	100	100	100
Nuclear Energy	0	1	1
Management and Administration	173	174	200
Environment, Safety and Health	170	180	180
Office of Civilian Radioactive Waste Management	1,122	1,122	1,170
Naval Petroleum Reserve	5	8	10
International Affairs and Energy Emergencies	16	16	25
Economic Regulatory Administration	70	70	75
OTHER FEDERAL AGENCIES:			
Environmental Protection Agency	86	179	200
Department of Defense	100	100	100
Congressional Budget Office	3	1	6
Bureau of Economic Analysis (Commerce)	2	2	2
Family Support Administration	275	275	275
Bureau of the Census (Commerce)	105	105	100
Total	$ 6,623	$ 6,768	$ 6,879

ENERGY INFORMATION ADMINISTRATION

QUESTIONS SUBMITTED BY THE HONORABLE RALPH REGULA

Oil Imports

Question: This past January we broke the record with regard to oil imports. Oil imports constituted 54 percent of our domestic consumption. In light of the events in Eastern Europe and the Soviet Union, with both regions about to enter growth phases in their economies and therefore producing substantially larger demands on the world energy supply, how do you project the U.S.'s ability to compete in the world oil market for foreign oil supplies? Do you see this rising tide of oil imports as cause for alarm? At what level do you believe our dependence on foreign oil will pose a threat to national security?

Answer: It is true that U.S. imports have been on the increase and, in our latest forecast contained in the Annual Energy Outlook 1990, we are forecasting an import dependency (net imports divided by domestic demand) of between 50 and 60 percent by 2000 compared to 41 percent on average in 1989. (Note: The 54 percent figure you quote is for gross imports. On a net import basis that figure would be 50 percent. We believe that level of dependency was weather-related and has decreased toward 40 percent in February.) Although oil's import share is forecast to increase, oil's importance in our overall energy balance continues to decrease. Yet oil remains our most important fuel source. Dependence on oil imports at any significant level is reason for concern, but not alarm as long as we are not totally dependent on any one supplier. Our dependence needs to be periodically reviewed in the context of producer country trade relations, U.S. and foreign allied strategic stock levels, excess production capacity on the world oil market, and the diversification of U.S. supply sources.

At least over the next decade, given the calm in the Persian Gulf and the Organization of Petroleum Exporting Countries' (OPEC) current plans toward fostering market stability and expansion of production capacity, there may not be reason to be overly concerned about import dependence. Allied strategic stocks continue to be built and excess production capacity exists on the world oil market. In addition, the Strategic Petroleum Reserve is sufficient to mitigate economic damage resulting from most potential disruptions. However, I believe we should continue to seek means to reduce dependence which can be justified according to economic merit.

Although there is considerable uncertainty in Eastern Europe, our forecast of Centrally Planned Economies supply balance contained in the EIA International Energy Outlook 1990 suggests that over the longer term, oil's energy share will decrease significantly as that region, primarily as a result of the Soviet Union's energy resources, switches to natural gas as its primary energy source and introduces conservation initiatives through world market related pricing of its petroleum resources.

International and Contingency Information

Question: You show a decrease in $177,000 for this program. Why are you cutting your request for a program that conducts analyses of international energy supply and consumption in the market economies at a time, when one would think this type of analysis is crucial to this nations decision makers?

Answer: In actuality, funding for the ongoing projects in this program is remaining level. There was an increase in FY 1989 and FY 1990 to fund one-time projects to automate the statistical responses associated with the international energy questionnaire and to provide improvements to the International Demand Modeling System. Both of these automation projects have been completed and further funding is not required.

Electricity Demand, Coal and Clean Air Bill

Question: As domestic oil production continues to decrease and energy consumption continues to increase something has to give. EIA has predicted that the increasing demand for energy/electricity will spur coal production. How will the President's Clean Air Bill, that is predicted to be passed by Congress this year, affect the ability of our nation's utilities to meet this increasing energy demand? What price will their customers have to pay in increased utility rates, to meet the Bill's requirements?

Answer: The Energy Information Administration is preparing an analysis of proposed revisions to the Clean Air Act at the request of the House Committee on Energy and Commerce. The results of the analysis, which will include both the supply options that electric utilities could employ and the effects of the proposal on electricity rates, will be completed by July 27, 1990.

Question: Exactly how much of an increase does EIA predict in coal production during the 1990's?

Answer: EIA forecasts that the Nation's coal production will increase by about 190 million short tons in the 1990's. With this increase, U.S. coal production is estimated to reach 1,178 million short tons in the year 2000 compared to an estimated 987 million short tons in 1990. This forecast was recently published in EIA's Annual Energy Outlook 1990.

Question: What means of meeting this increased energy/electricity demand does EIA anticipate that the utilities will employ?

Answer: Numerous options exist to meet growing demand. Increased utilization of existing capacity, utility-instituted demand side management programs (which are estimated to provide an additional 171 billion kilowatthours between 1989 and 2010) and purchases of power from foreign utilities (8 billion kilowatthours in 2010) will all contribute to supply. Utilities are also expected to purchase 334 billion kilowatthours from nonutility sources by 2010, equivalent to 8 percent of total electricity sales. In addition, it is expected that over this period only 6 percent of utility capacity currently installed will be retired, while over 50 percent will be partially or fully life extended. However, even with the above sources, which include 76 gigawatts of additional nonutility capacity, it is estimated that utilities will need to build 271 gigawatts of capacity by 2010, of which 39 gigawatts are currently planned. Through 2000, 134 gigawatts of new capacity is expected; most of that increment is expected to be gas-fired combined cycle plants or cumbustion turbines. After 2000, an additional 213 gigawatts is expected; coal fire plants dominate these increments of new capacity. Also note that projections and forecasts over this twenty year time horizon are subject to a substantial margin of error. Significant technological change in the way electric power is generated or used could alter the actual outcome.

Question: How long does it take to permit and build a coal burning utility plant under current regulations? At what cost?

Answer: Under current regulations, it is estimated that the average utility coal plant will take 8 years to bring on line. The overnight capital cost excluding interest is between $1266 and $1448 per kilowatt in 1989 dollars, depending on the rank and sulfur content of the coal burned. It is expected that 3 years will be required to acquire the necessary licenses and permits, and 5 years will be needed to actually construct the plant.

Question: How long would the process take under the President's original bill (H.R. 3030); under the bi-partisan Senate bill? At what cost?

Answer: Because most new coal plants will be constructed with flue gas desulfurization (FGD) units in order to meet existing clean air regulations, it is not expected that significant additional time or money will be needed to comply with the provisions in either bill. Some additional time may be required to acquire emission permits from the Environmental Protection Agency and additional costs may be incurred when standards for those air toxics which cannot be controlled by FGD units (such as mercury) are promulgated.

Alternative Fuels Information

Question: You are not requesting an increase in your Alternate Fuels Information Program Activity. In light of the emphasis being placed on the use of alternative fuels in the various Clean Air proposals are you planning on increasing the scope of this program in the future?

Answer: EIA reallocated FY 1990 resources to increase the level of effort on alternative fuels. Full Time Equivalent positions have been raised from 1.0 to 3.0 and contract funds have been increased to $185,000. EIA is currently preparing a long-range plan for all activities, and part of this process will be an examination of data and analysis capabilities in the area of renewable energy.

Media Use of EIA

Question: You state that your organization is a major source of energy information for the media, such as Forbes, Business Week, New York Times, Reuters News Services, and the radio and television networks. Do you charge these organizations for the information/services you provide them with? If not, why not?

Answer: It is EIA's policy not to charge media organizations for our publications because the media provide a valuable service to EIA and to users of energy information as secondary disseminators of energy information.

Heating Oil and Propane Data

Question: I received a letter from the Northeast-Midwest Congressional Coalition dealing with EIA's inability to collect information dealing with propane-related supply and price requests from Members of Congress or the public. During a recent heating oil/propane crisis, DOE relied on increasingly unreliable and incomplete data supplied by states on a voluntary basis. Up to 1988, EIA had a mechanism to collect biweekly, comparable information on heating oil supply and wholesale and retail prices from states heavily dependent on heating oil. DOE had stated that it would rely on energy markets to resolve crisis such as the propane one. How can EIA judge the success of their strategy to allow the market to handle the situation if they do not have reliable data to base their analysis on?

Answer: EIA regularly collects and publishes reliable monthly data on primary inventories and prices and sales volumes of propane for resale and for end use, as reported by all refiners and gas plant operators. These data are available at the State, PADD, and national levels. EIA also collects and publishes on a monthly basis primary inventories and wholesale and residential price statistics for distillate fuel oil at the same aggregate levels. The distillate price data are collected from refiners, gas plant operators, and a sample of resellers and retailers.

While these data are an accurate measure of market trends month to month, they are monthly averages, which smooth over rapid price changes in a volatile market, such as occurred this past winter. Moreover, these data are not available for use and release prior to publication 60 days after the end of the reporting period.

In order to monitor and evaluate current trends in petroleum supplies, EIA collects and publishes weekly statistics on refinery activity, petroleum product production, imports, primary inventory levels, and demand at the national, and in some cases, PADD levels. With the addition this winter of propane statistics, all major products and heating fuels are covered in these surveys and the results are published both electronically and in the Weekly Petroleum Status Report.

In addition, EIA has surveyed since 1979, through its joint EIA/State Heating Oil Program, State level primary inventories, and wholesale and residential prices of heating oil on a twice-a-month basis. Although small grants have not been provided to the States since fiscal year 1988 to fund their data collection efforts, these series continue to be published in the EIA Winter Distillate Report for all but three of the original States. Furthermore, this report continues to be widely used by trade publications, State and Congressional offices, and the industry at large as the definitive source of residential prices. As such, these data were available to EIA for monitoring the December crisis and were used in its A Short-Term Analysis of Heating Fuel Market Behavior to evaluate the market's rapid movements.

EIA did not have such data for propane at the onset of the crisis in December because neither the participating States nor the Federal government had ever experienced a need to develop these programs. To rectify this situation, in the light of last winter's events, EIA is proposing to expand its Federal/State cooperative program to enable those States, in PADD's IA, IB and II, which wish to participate to collect inventories and prices for distillate and propane within their respective borders on a bi-weekly basis. Information from this cooperative program would be made available by the States on a company-specific basis to the EIA which will aggregate and publish the results thereof.

In addition, the EIA will develop with the cooperation of the participating States, a standby data collection and dissemination program for the aforementioned fuels, which is capable of rapid implementation should a need for more frequent data arise.

Bi-weekly residential heating oil and propane prices would be collected by State for those States participating in the program. Wholesale (rack/terminal) prices for both products would be obtained by EIA from non-EIA secondary sources. Company level information would be provided to the EIA and aggregated and disseminated by EIA in printed and electronic form throughout the October-March heating season. Standby capability to invoke weekly collection would be required.

State level, primary inventory estimates would be obtained by the States on a bi-weekly basis for distillate and/or propane. These data would be collected through the use of cut-off samples for refiners, terminal operators, etc., providing adequate coverage of each market. Respondents, product definitions, timing, etc., would be consistent with, or taken from, current EIA propane and distillate surveys. While secondary stock surveys are not envisioned, some consideration may be given to non-EIA secondary sources, or in-place survey strategies to be implemented in the event of an emergency.

The program would also entail periodic conferences of DOE/EIA, State, and industry officials. In the event of an emergency, such as the December heating oil and propane crises, this group would pinpoint the nature, extent, and implications of such disruptions. The group might also make suggestions for mitigating actions.

OCS Sales

Question: The *National Journal* reported on President Bush's effort to fulfill a campaign declaration to analyze three OCS sales based on environmental or aesthetic sensititivity of blocks contained within the sale areas. He named an Administration task force to study the issues. This group included DOE policy makers. In the March 10 article the *Journal* reports that President Bush ordered more information from Energy on the disputed tracts. Exactly what type of information are you preparing on these areas? Are there any agencies within the Department involved in fulfilling this additional request?

Answer: The Department of Energy has not provided any additional information.

Question: DOI's Minerals Management Service has announced that they are delaying releasing their OCS leasing plan, awaiting the President's decision on these three sales. When will this information from DOE become available?

Answer: As noted above, the Department of Energy has not provided any additional information; however, a decision is pending from the President.

TUESDAY, MARCH 20, 1990.

OFFICE OF HEARINGS AND APPEALS

WITNESS

GEORGE B. BREZNAY, DIRECTOR

OPENING REMARKS

Mr. **ATKINS.** George B. Breznay, Director of the Office of Hearings and Appeals. Do you have any staff that you want with you?

Mr. **BREZNAY.** No. I'm going to do it by myself.

Mr. **ATKINS.** Okay. If you could just identify yourself for the record for the stenographer.

Mr. **BREZNAY.** I'm George B. Breznay, Director of the Office of Hearings and Appeals of the Department of Energy.

Mr. **ATKINS.** Do you have a statement? I don't know if you want to go over any of the highlights of that. Your complete statement will go in the record.

[The prepared statement of Mr. Breznay follows:]

Statement of George B. Breznay
Director, Office of Hearings and Appeals
Department of Energy
Before the
Committee on Appropriations
Subcommittee on Interior and Related Agencies
United States House of Representatives
March 20, 1990

Mr. Chairman, members of the Committee, I appreciate the opportunity to appear before you today to discuss the operations of the Office of Hearings and Appeals.

We continue to make considerable progress in all of our program areas, particularly in the area of Subpart V proceedings. These are proceedings in which we accept claims for refund of oil overcharge escrow monies which have been received through Consent Orders or other enforcement actions. During FY 1989, we processed over 59,000 refund applications, a 55 percent increase from the prior year's record level of completed cases. Over $152 million in refunds was distributed to these claimants, a three-fold increase from FY 1988. In addition, pursuant to the Petroleum Overcharge Distribution and Restitution Act, our FY 1989 refund proceeding closings enabled us to transfer more than $40 million in "excess" funds to the Federal treasury in FY 1990 for deficit reduction.

We also devoted significant time to other important program areas during this past fiscal year. For example, we have continued to actively adjudicate enforcement matters, with 64 separate cases concluded during the past fiscal year. Like most enforcement matters, these cases have been vigorously contested -- mainly because of the large sums of money at issue -- and have involved complex legal and factual issues requiring detailed written opinions explaining our determinations. Our record in having these determinations sustained on appeal continues to be excellent.

During FY 1989 we reduced our inventory of open cases in the enforcement area by one-third. We also issued written determinations in 151 non-enforcement cases involving petitions related to the implementation of Subpart V procedures, Freedom of Information Act appeals, exception requests and other matters.

Our activities during FY 1990 have remained at a high level. During the current fiscal year, we have processed nearly 10,000 refund applications and distributed nearly $44 million. Consequently, as of January 31, 1990, we have approved a grand total of 132,400 applications for refund filed by individuals, large and small businesses in and outside of the oil industry, utilities, municipalities, housing authorities, and other government entities -- virtually every segment of the economy. In all, we have directed refunds to these claimants amounting to over $520 million. In addition, in FY 1991 we expect to distribute an additional sum of $25 million to the Federal treasury.

As of January 31, 1990, over 22,000 refund applications remained in inventory. That is a large number. Moreover, these remaining cases are the most complex we have received and are not susceptible to "batch processing." Therefore, the case closure rates achieved to date for these applications will in all likelihood fall. We also expect to receive a significant additional number of refund applications in FY 1990 and FY 1991 -- approximately 11,000 to 22,000 applications in each year. During the remainder of FY 1990 and FY 1991, we expect to continue to process these refund applications, as well as to resolve virtually all of our remaining enforcement cases and the continuing flow of non-enforcement cases. I expect inventory levels for all types of cases, including refund cases, to be down again by fiscal year end.

Our FY 1991 budget request of $5.4 million is $449,000 less than the appropriation for FY 1990. This level of funding will permit a ceiling of 74 Full-Time Equivalent employees, a reduction of 15 FTEs from current staffing levels. That amount is sufficient for program needs.

This concludes my prepared presentation. I would be happy to respond to any questions which you might have.

Mr. BREZNAY. I'd like to make a short statement, Mr. Chairman. Once again, this committee has saved the best for last, and I assure you this will be just a brief status report.

We're the adjudicators for the Department of Energy, and we're active in three primary areas. One is handling enforcement cases, where we provide a forum for the ERA to charge the respondents with regulatory violations, hearings and eventually a departmental decision. Secondly, we're active in the refund area, distributing oil overcharge monies to the public. Last, we're the adjudicators for general department-wide matters, such as Freedom of Information Act appeals.

If I could just say a word about the refund area. Last year when I was here testifying in support of the OHA budget request, I had my fingers crossed inasmuch as we had an enormous workload at the time—50,000 refund applications in-house. I had my fingers crossed that we'd be able to cope with that workload. I'm happy to report that since that time we have done roughly 60,000 refund cases, adjudicated those cases, and distributed over $150 million in oil overcharges to those applicants.

We also have come up with $40 million in excess oil overcharges that have been distributed to the States via energy conservation programs. Those are monies that are left after we identify and pay direct claimants. The numbers are big, but each one of those claims requires analysis and a written determination. It is a job that is becoming increasingly more complex. The cases—and we're down to about 20,000 refund applications in inventory—tend to be the larger and more difficult ones.

Just yesterday I signed a decision approving a couple of refunds for two large paper companies. Each one of those was in excess of half-a-million dollars. Naturally, when those amounts of money are at stake, we tend to do a more careful analysis and require supporting information for a refund claim, whereas if it's from a "mom and pop" retail gas station, we wouldn't go into it as deeply.

I'm here asking for $5.4 million for fiscal year 1991. That funding is adequate to support 74 FTEs. I project we will continue to be extremely busy. Recently, we kicked off the Texaco refund proceeding. That involves $1.25 billion. I think it is the biggest settlement that the Department of Energy has entered into—$1.25 billion plus interest. Over $100 million of that has gone into a refined product refund proceeding, which has just gotten underway. Mailings went out to 35,000 customers of Texaco, and we expect somewhere in the range of 10,000 to 25,000 claims. The claims period for Texaco claims goes on into fiscal year 1991, so we'll be heavily engaged in that refund proceeding for some period in the future.

Thank you, Mr. Chairman.

REFUND WORKLOAD

Mr. ATKINS. Thank you. Can you tell me, do you expect to receive significant numbers of refund requests through the next two years?

Mr. BREZNAY. I do. We're projecting between 10,000 and 20,000, roughly, each year. That figure is correct for the current fiscal year, and I expect largely because of the Texaco proceeding that we'll be at that level into fiscal year 1991.

IMPACT OF STAFFING REDUCTION

Mr. **Atkins**. With your reduction of 15 FTEs in your budget, are you going to be able to keep up with or to reduce the backlog?

Mr. **Breznay**. It will give us an adequate level of funding, Mr. Chairman. Naturally, when your staff comes down in size, there will be an effect. Because of the way our office is configured, it would probably hit the professional area hardest. I figure we'll come down in the professional area by roughly one-quarter of our staff. I expect there will be some decline in overall productivity.

Mr. **Atkins**. Let me just suggest for those—how many claimants are there on the Texaco case? What did you say, 35,000?

Mr. **Breznay**. Well, the customer list was 35,000.

Mr. **Atkins**. 35,000.

Mr. **Breznay**. These are only the largest customers.

Mr. **Atkins**. What would you guess will be the effect on those people from your reduction in FTEs?

Mr. **Breznay**. I assume in fiscal year 1991, with a staff reduction, we'll be able to process three applications, whereas we, under current staffing levels, would be able to process four. Roughly, we'd be down 25 percent. The people will just get their refund later is what it means.

Mr. **Atkins**. So it means that they'll wait 25 percent longer on average?

Mr. **Breznay**. Is that the way the math works? I guess that's the way it would operate.

Mr. **Atkins**. On the average now, how long does a request remain in the backlog before it is processed?

Mr. **Breznay**. Well, on our case processing time, I have some figures—you're talking in the refund area now, I assume. We're still under a year in the time it takes to reach a conclusion. It took 364 days in the current fiscal year for an application to be decided.

Mr. **Atkins**. How many days?

Mr. **Breznay**. 364 days, almost a year. That has been increasing. In fiscal year 1988, it was 236 days, then 331 in fiscal year 1989. Currently it is 364 days.

TEXACO PROCEEDING

Mr. **Atkins**. How long, if you just take the Texaco case as an example—that's the largest case you have pending now?

Mr. **Breznay**. That's right.

Mr. **Atkins**. Okay. For those 35,000 people, how long have they been waiting?

Mr. **Breznay**. Well, we just kicked it off.

Mr. **Atkins**. No, I mean in terms of when——

Mr. **Breznay**. When the settlement was, or——

Mr. **Atkins**. Well, when the overcharge occurred.

Mr. **Breznay**. I lived with that case through the adjudication, and it was a long one, believe me. I still remember that it was in 1979 that the Department brought formal charges in the crude oil area against Texaco. The crude oil overcharge has formed the primary basis for the settlement.

The audit period, though, began in 1973. The crude oil overcharge, which is what Texaco was alleged to have caused, occurred in 1973 and they worked their way through the——

Mr. **Atkins**. Well, it isn't just alleged at this point. Is it?

Mr. **Breznay**. Well, they settled in a manner, Mr. Chairman, which means they didn't admit any of the allegations.

Mr. **Atkins**. They didn't admit culpability.

Mr. **Breznay**. They did, however, agree to pay $1.25 billion plus interest.

Mr. **Atkins**. They didn't do it, but they'll pay $1.25 billion.

Mr. **Breznay**. So the effects on the economy were felt in the 1970s. That is correct.

Mr. **Atkins**. Is it fair to make these people wait even longer on that? I know that the wheels of justice grind slow, but that seems a little bit excessive to me. And then, to add a 25 percent delay on top of that, just seems unfair to me.

Mr. **Breznay**. Well, we will try to get out the decisions as fast as we can with whatever level of funding we have, Mr. Chairman.

IMPACT ON TEXACO OF DELAY IN REFUND PROCESSING

Mr. **Atkins**. What's the effect for Texaco, does it make any difference to them, in terms of the delay?

Mr. **Breznay**. No.

Mr. **Atkins**. Is it economically advantageous to them or disadvantageous?

Mr. **Breznay**. I think Texaco is happy to—in fact, they're cooperating with the way we're running the refund proceeding. I think they're happy to see that customers will share in the settlement that they have agreed to. In terms of how fast the refund proceeding goes, I think their interests are pretty remote.

Mr. **Atkins**. What is the rate of interest that they put on this?

Mr. **Breznay**. It is fixed in the settlement, and I just don't have the number in front of me, Mr. Chairman.

Mr. **Atkins**. Have you looked at how that compares with the rate of return that Texaco gets on their investments?

Mr. **Breznay**. I haven't.

Mr. **Atkins**. I'd be curious. If you could compute those numbers for our record, I'd appreciate it.

Mr. **Breznay**. Well, what I can tell you is that the settlement was to take place over a number of years. Texaco has just made a payment on March 1, which I believe is the second or third, and there are at least three more payments which they have to make under the settlement. What is it you're asking me to do, Mr. Chairman?

Mr. **Atkins**. Compute the difference for Texaco between whatever rate of interest that they are charged on the money the longer the settlement takes and what the rate of return is that they have on their own internal funds. In other words, what they would have to pay, or what rate of return on their investment they are forfeiting for the money versus what it costs them additionally in interest charges on the payouts that they make in the settlement.

Mr. **Breznay**. If I can find an internal rate of return number for Texaco, I'd be happy to make that comparison, Mr. Chairman.

[The information follows:]

Texaco Internal Rate of Return and Interest Rate

As a result of the Consent Order between Texaco and the DOE, Texaco is paying interest on the outstanding balance of the $1.25 billion it agreed to pay the government at a fixed rate of 8.85 percent. The schedule of payments, and hence the total amount of interest paid, is fixed by the Consent Order. OHA does not have access to specific information as to Texaco's internal rate of return, but estimates that it would be approximately 15–20 percent.

SCHEDULE OF TEXACO PAYMENTS

Mr. **Atkins**. As I understand the process, Texaco has a strict schedule established by the Justice Department for their payments. Actually, it's by the Department of——

Mr. **Breznay**. By the Department of Energy. That's right. There are specific dates and specific numbers for each payment.

Mr. **Atkins**. So it makes no difference to Texaco, they have to pay on a fixed schedule that doesn't change.

Mr. **Breznay**. That is correct.

Mr. **Atkins**. So the Government then gets that money and, by the increased time that it takes to make the payouts to the claimants, the Federal Government essentially has that money and is able to collect the interest on it?

Mr. **Breznay**. It sits in the Treasury, and it is an interest-bearing account. What happens at the very end is interesting. The faster we can process a case, the faster the money that is not identified for claimants gets turned around and is used for deficit reduction through the Petroleum Overcharge Distribution and Restitution Act of 1986. That act specifies that when we are all through, the excess money comes back for State energy conservation programs and effectively backs up otherwise-appropriated monies.

Mr. **Atkins**. So you've got two effects by the delay then. It seems that the first effect is that the Government is collecting interest on claimants' monies, and it takes them even longer to get the money which is owed to them. The second——

Mr. **Breznay**. Excuse me. The claimants do get their share of the interest. In other words, the Government doesn't keep the interest. We attribute any interest earned to the refund, so the longer the Government has the money in escrow, the larger the refund would be.

Mr. **Atkins**. So actually the refund is——

Mr. **Breznay**. We're not slowing down so we can get a windfall.

Mr. **Atkins**. You're delaying the point at which State energy conservation programs have funds available for them.

Mr. **Breznay**. The longer time it takes for us to do all the claims, the longer it takes to give the residue for energy programs.

ESTIMATE OF EXCESS REFUND MONIES

Mr. **Atkins**. Right. So it would delay the date in which the State energy conservation programs get their money. What is your prediction on the amount of excess petroleum overcharge funds that are available for use in State energy conservation programs for fiscal year 1990?

Mr. **Breznay**. We did an estimate, Mr. Chairman, and delivered it to the committees here on the hill on March 1. The number that we project is for fiscal year 1991, because we have already done the 1990———

Mr. **Atkins**. So what's your figure for 1990?

Mr. **Breznay**. It was roughly $40 million that we———

Mr. **Atkins**. $40 million?

Mr. **Breznay** [continuing]. Generated in excess funds. Our estimate on March 1 was $25 million, which would be made available on or about November 1 of this year. Our experience is that the number usually goes up from, say, in this case $25 million, but we can't really say how much. Last year it was $40 million, and our current estimate for fiscal year 1991 is $25 million.

Mr. **Atkins**. $25 million?

Mr. **Breznay**. Right.

Mr. **Atkins**. And you expect that to go up some?

Mr. **Breznay**. Because in the interval we'll be processing claims, and some more money will drop out into the residue.

Mr. **Atkins**. Now could you submit for the record for this committee how much the States could expect if you don't have the reduction in FTEs so that you are able to process them 25 percent faster, what the impact on the States would be?

Mr. **Breznay**. For 1991, Mr. Chairman, it would be minimal because, remember, we're talking about staffing levels beginning in October, so we'd only have one month.

Mr. **Atkins**. So you'd have a one-month effect in 1991, and then the effect would be in 1992.

Mr. **Breznay**. Right. It would affect the next PODRA estimate, which would be due March 1, 1991.

[The information follows:]

IMPACT OF STAFFING REDUCTIONS ON FUNDS TO STATES

At this time, OHA is not able to estimate the amount of "excess" funds that will be available to the States in FY 1992 under the Petroleum Overcharge Distribution and Restitution Act of 1986 (PODRA), and therefore cannot estimate the absolute effect on that amount of a staffing reduction of 15 FTEs. It is possible that a reduction of 15 FTEs would be taken in areas that would not substantially affect the PODRA distribution. However, if the reduction were taken in a manner that would affect the PODRA distribution, OHA estimates that such a reduction could decrease the amount of money available by approximately 25 percent. If such a staffing reduction had been implemented in FY 1990, the amount of "excess" monies available to the States in FY 1991 would thus be reduced by approximately $6.3 million.

Mr. **Atkins**. Okay. Right. Thank you very much.

Mr. **Breznay**. Thank you, Mr. Chairman.

Mr. **Atkins**. The meeting is adjourned, and we'll reconvene tomorrow at 1:30.

[Questions and answers for the record follow:]

ADDITIONAL COMMITTEE QUESTIONS

Workload and Personnel

Question: Please review the status of your backlog of refund requests as compared to last year. How many cases were processed in the past year?

Answer: During FY 1989, 59,200 refund applications were processed.

Question: How many requests were received?

Answer: During FY 1989, 18,881 refund applications were received.

Question: What was the value of refunds processed in FY 1989?

Answer: During FY 1989, $147.4 million in direct restitution and $5.1 million in indirect restitution -- a total of $152.5 million -- was made to individual claimants. This does not include $40.6 million provided to the States as indirect restitution through the Petroleum Overcharge Distribution and Restitution Act of 1986.

Question: When do you expect the level of refund requests to decrease?

Answer: In FY 1989, OHA received approximately 19,000 refund applications. In FY 1990 and again in FY 1991 OHA expects to receive as many as 11,000 to 22,000 refund applications. OHA does not expect recent levels of receipts to decrease until after FY 1991 at the earliest. In addition, in the crude oil refund proceeding -- by far the largest refund proceeding to date with receipts of nearly 80,000 applications -- a series of refunds will continue to be made to all qualified applicants over the course of the next several years as crude oil monies continue to be received. As a result, while not appearing as open cases in OHA's refund inventory, these supplemental payments do entail a continued workload for OHA.

Question: If additional personnel proposed for reduction were retained, how much additional funding would be required in FY 1991?

Answer: OHA estimates that approximately $650,000 in additional funding would be required during FY 1991.

Question: Will the compliance workload decrease in FY 1991?

Answer: The number of compliance cases in inventory is expected to decrease during the remainder of FY 1990 and FY 1991. However, these remaining cases are extremely complex and time-consuming and, as a result, the compliance workload expressed in terms of man-hours is not likely to decrease significantly during FY 1991.

Question: Your budget justification states that virtually all compliance cases will be resolved by the end of FY 1991. Is this still a valid assumption?

Answer: Based on the best available current information, we continue to expect to resolve virtually all compliance cases by the end of FY 1991. However, there are a number of factors beyond our control which could affect this. For example, the compliance caseload could increase if a reviewing agency or court were to remand a matter to us. In addition, a new court decision could occur requiring re-evaluation of legal theories or changes in the nature of the ERA's legal position. Similarly, based on facts developed during an OHA adjudication, the ERA itself could move to amend its position in an ongoing proceeding, thereby protracting the case. Any of these factors could necessitate a need for additional time to close out remaining compliance cases.

Question: Does resolution mean that no compliance workload at all will exist?

Answer: In addition to analyzing compliance cases that might not have been completed by the end of FY 1991, the compliance workload for FY 1992 will include support for ERA litigation at FERC and before the courts of remedial orders issued by OHA.

Question: In terms of manpower, what implications does completion of compliance activity have after FY 1991?

Answer: As the workload in the compliance area in the past few years has decreased, OHA has shifted resources to meet its increasing workload in the refund area. Consequently, OHA expects to be fully engaged in case adjudication, notwithstanding the closeout of compliance activity.

Stripper Well Plans

Question: Have you approved any additional State conservation plans using stripper well funds since the ones provided as a result of last year's hearing?

Answer: Since last year's hearing, OHA has considered or is in the process of considering three such requests. One of these requests has been approved.

Question: If so, provide summary information for the record as you did last year.

Answer: First, the State of Washington sought reconsideration of a prior OHA decision denying its request to refurbish short line railroads serving inland agricultural ports (Case No. KER-0046). This request, which was pending at the time of last year's hearing, was approved in a decision issued on March 6, 1989. Second, the State of Arkansas requested reconsideration of an OHA decision denying its plan to use crude oil overcharge funds for a demonstration photovoltaic electric generation system at the Meadowcreek Project (Case No. KER-0049). This request was denied. Finally, the State of New York is seeking reconsideration of a decision by the Assistant Secretary for Conservation and Renewable Energy denying its request to use stripper well funds for plugging abandoned oil wells (Case No. LEG-0001). This request is pending at this time.

Thursday, March 29, 1990.

FOSSIL ENERGY

WITNESSES

ROBERT H. GENTILE, ASSISTANT SECRETARY, FOSSIL ENERGY

MICHAEL R. McELWRATH, PRINCIPAL DEPUTY ASSISTANT SECRETARY

JEREMIAH E. WALSH, JR., DEPUTY ASSISTANT SECRETARY FOR MANAGEMENT, FUNDAMENTAL RESEARCH AND COOPERATIVE DEVELOPMENT

JACK S. SIEGEL, DEPUTY ASSISTANT SECRETARY FOR COAL TECHNOLOGY

MARVIN I. SINGER, DEPUTY ASSISTANT SECRETARY FOR OIL, GAS, SHALE AND SPECIAL TECHNOLOGIES

RICHARD D. FURIGA, DEPUTY ASSISTANT SECRETARY FOR PETROLEUM RESERVES

HOWARD G. BORGSTROM, DIRECTOR, OFFICE OF PLANNING AND FINANCIAL MANAGEMENT FOR PETROLEUM RESERVES

CAPTAIN ROBERT TAYLOR, USN, DIRECTOR, OFFICE OF NAVAL PETROLEUM AND OIL SHALE RESERVES

DON JUCKETT, DIRECTOR, OFFICE OF GEOSCIENCE RESEARCH

Opening Remarks

Mr. Atkins (acting chairman). The hearing will come to order.

We will be hearing today from Assistant Secretary for Fossil Energy, Robert H. Gentile. Mr. Secretary, welcome.

Mr. Gentile. Thank you.

Mr. Atkins. If you could identify for the record the people who are joining you at the table. You have two statements and a biography, and those will be entered in the record in full. If you'd like to make any opening remarks, we would welcome those.

[The biography and statements of Mr. Gentile follow:]

Department of Energy
Washington, DC 20585

Robert H. Gentile
Assistant Secretary for Fossil Energy
U.S. Department of Energy

Robert H. Gentile is the Department of Energy's Assistant Secretary for Fossil Energy, a position that oversees the Department's coal, oil and natural gas programs. He was sworn in as Assistant Secretary on February 27, 1990, after being nominated by President Bush on January 25, 1990, and confirmed by the U.S. Senate on February 22.

As Assistant Secretary for Fossil Energy, Gentile manages the federal government's programs to develop advanced coal, petroleum and natural gas technologies. Included is oversight of the $5 billion Clean Coal Technology Program, the government's largest single energy and environmental initiative. He is also responsible for managing the federal fossil fuel research programs which involve nearly 700 government-sponsored projects carried out by universities, private industry and federal laboratories.

Gentile also oversees the Strategic Petroleum Reserve, the nation's emergency crude oil stockpile, and the operation of the government-owned oil fields in California and Wyoming that make up the Naval Petroleum Reserves. He is also responsible for the federal government's authorization of imports and exports of natural gas and the export of electricity.

Prior to his service with the Department of Energy, Gentile headed the Office of Surface Mining Reclamation and Enforcement from March 20, 1988, to August 14, 1989, first as acting director, then as President Reagan's appointee. He has also served as Liaison for Coal Affairs to both the Secretary of the Interior and the Interior Department's Assistant Secretary for Land and Minerals Management.

From 1982 to 1986, Gentile was Chief Executive Officer of The Ohio River Collieries Group, a consortium of companies conducting coal operations, construction and land development, agriculture and trucking operations in eastern Ohio. For seven years prior to that, he was President of N&G Construction Company which became part of The Ohio River Collieries Group.

Gentile was a founding member of the Mining and Reclamation Council, a national trade association that has since become part of the National Coal Association. He has served on the Board of the Ohio Coal Energy Association and as a charter member of the National Coal Council, a private sector advisory panel to the Secretary of Energy.

From 1970 to 1975, Gentile was a Department of State Foreign Service Officer assigned to the Peace Corps. His assignments included three years as Deputy Director of Peace Corps Operations in Brazil.

Gentile holds a B.A. in political philosophy from Franciscan University of Steubenville, Ohio, and an M.B.A. in international trade and finance from the University of Toledo. He speaks several languages.

February 1990

The FY 1991 Fossil Energy Budget Request

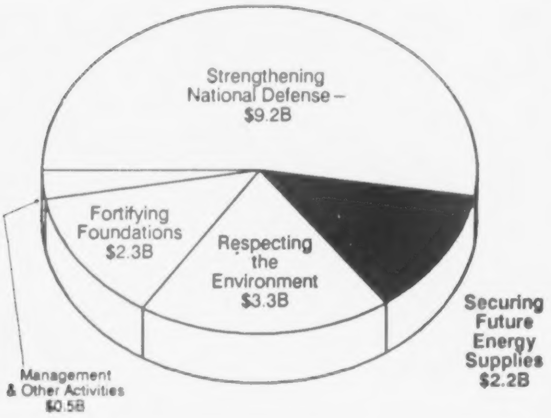
Statement of Robert H. Gentile
Assistant Secretary for Fossil Energy
U.S. Department of Energy
to the
Committee on Appropriations
Subcommittee on Interior and Related Agencies
on
March 29, 1990

Of the $2.2 billion earmarked for "Securing Future Energy Supplies" in the Department of Energy's fiscal 1991 budget request, $658 million is proposed for fossil energy related technologies – i.e. for advanced processes that can extract more effectively or use more cleanly and efficiently the nation's supplies of coal, petroleum and natural gas.

As the charts below show, this funding request is allocated among two major components:

- The Clean Coal Technology Program – FY 1991 request: $456 million;
- The Fossil Energy R&D Program – FY 1991 request: $202.3 million.

FY 1991 DOE Budget Request



Fossil fuels currently account for almost 89 percent of the energy consumed in the U.S. Even if the nation adopts more aggressive energy conservation and efficiency measures, makes greater use of solar and renewable energy resources, and restores the nuclear power option – all of which are necessary to a balanced, more secure energy future – fossil fuels will continue to supply the majority of the nation's energy needs well into the next century. Assuring availability of these fuels and the technologies to use them cleanly and efficiently is a major element of national energy policy. To maintain a viable fossil fuel option, the FY 1991 Fossil Energy program has been shaped by five major factors:

45-2

1) Reducing the release of pollutants while simultaneously retaining, or enhancing, economic competitiveness.

There is no reason why the nation cannot call on its technological prowess to achieve both clean air and economic growth. The President's July 21, 1989, Clean Air Act proposal, if approved by Congress, can be the most far-reaching environmental step taken by any industrialized nation in the last 20 years. Of particular relevance to the Fossil Energy program are provisions:

- to control through market based solutions, emissions of pollutants known to cause acid rain;
- to regulate hazardous air emissions from stationary sources; and
- to establish programs for the use of clean fuels in vehicles.

Many of the technologies being demonstrated in the Clean Coal Technology Program or being developed in the Fossil Energy R&D program can help achieve the equal goals of a better environment and a healthy economy. Some of the advanced concepts could play a role in meeting the compliance deadlines established in the President's proposal; others will become vitally important after the deadlines by allowing sustained economic growth within the emission caps envisioned by the President's bill.

In light of this, the FY 1991 budget proposal places even greater emphasis on improving environmental performance of technologies by:

a) addressing global warming concerns, particularly through increased emphasis on development of high efficiency coal utilization systems;

b) pursuing a development schedule responsive to proposed Clean Air Act changes for technologies that can reduce acid rain pollutants or provide clean alternate fuels;

c) initiating development of pollution control technologies capable of achieving very high percentages of emission reductions anticipated for new plants by the proposed Clean Air Act changes, and

d) continuing the DOE/industry Clean Coal Technology joint effort to demonstrate innovative emission controls and power generating technologies that have near-term benefits.

2) Slowing the decline in domestic oil production and countering the rise in imported oil levels.

U.S. oil imports are growing rapidly since lower oil prices have reduced domestic exploration and production. Domestic oil production in 1989 was at its lowest point in 25 years. The Energy Information Administration's 1989 Annual Energy Outlook shows gross oil imports (crude and petroleum products) rising from 47% of domestic consumption in

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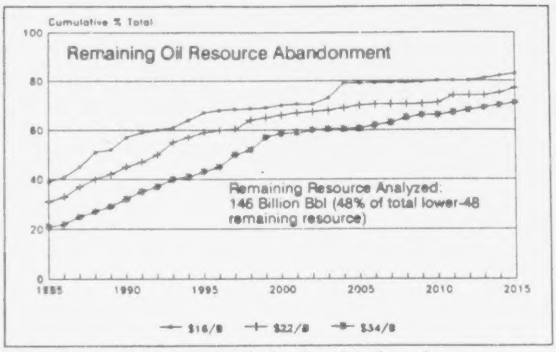


1987 to 53% in 1990 and to 66% by the year 2000 (in the "base case").

Particularly alarming is the loss of access to existing oil resources brought about by the accelerating pace of oil field abandonments.

In January 1990, the Department issued a study showing that as much as 40% of the nation's oil resource has already been abandoned – up from 30% in 1980 – and if oil prices remain at recent levels (although this is not expected), the figure could rise to 70% shortly after the year 2000. As the chart shows, even if oil prices were to rise to $34 per barrel, the study predicts that companies will lose economic access to more than 60% of the remaining domestic oil resource, outside of Alaska, by the turn of the century. (It should be noted that Alaska accounts for 25% of U.S. production and while it currently does not have an abandonment problem, production from currently producing fields is declining.)

In light of this, the Department has proposed a major restructuring of its oil and gas research programs, with a greater near-term focus on keeping those wells in production that have a high potential for abandonment until longer-range, more effective recovery technology can be developed. This represents a shift in previous government research policies which emphasized longer-term, more basic research. The FY 1991 proposed oil and gas program continues the transition to this new program emphasis by including:

a) program priorities based on resource volumes, risk of resource abandonment and resource-specific barriers to recovery;

b) a major new effort to work jointly with a industry-university-state consortia to develop a better understanding of reservoir geoscience and assist industry in prolonging the life of high potential oil fields that risk near-term abandonment;

c) a more aggressive technology transfer program to apprise operators of techniques that can keep economically marginal fields in operation; and

d) a new research effort into understanding and managing the environmental impacts of oil and gas extraction processes.

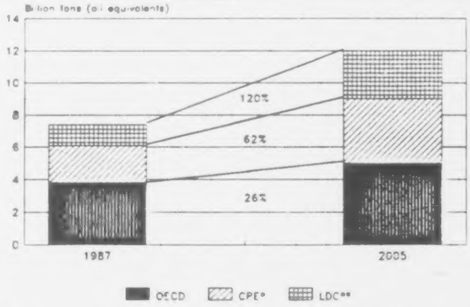
3) Encouraging interfuel and intrafuel competition.

While this Administration continues to rely on free market forces to determine fuel choices, it is also helping to ensure a "level playing field" by elimating non-technical constrains on demand (e.g., non-productive regulations) and fostering development of technologies that can reduce costs, increase confidence in the availability of domestic resources, and offer new end-use options that can encourage competition among fuels. DOE's Fossil Energy programs also promote the development of interfuel competition and markets for U.S. natural gas and electricity through its regulation of natural gas and electricity imports and exports. These programs assure the availability of gas supplies to supplement domestic production. In some areas, they represent the majority of gas available to the market, since domestic production cannot be readily delivered to these areas. These supplies promote interfuel competition and boost consumer confidence in the reliability of natural gas.

Fossil Energy's regulation of electric import and export functions plays much the same role as that of gas. In addition, it adds to the reliability of the nation's electrical system by increasing its integration into the entire North American grid and thus providing an extra degree of stability that lessens the chance of blackouts.

4) Helping reduce the U.S. trade deficit by encouraging and assisting U.S. industry in identifying global markets and developing effective international marketing strategies.

World Primary Energy Requirements



* Centrally Planned Economies ** Less Developed Countries

U.S. owned advanced technologies will become increasingly important to a world being shaped by heightened environmental and economic priorities. The International Energy Agency recently forecast that in the year 2005 the world will be using almost 50% more energy than today – and about 90% of that energy will still come from fossil fuels. With the economic and social changes occurring in eastern Europe and the accelerating industrialization of many developing nations, the need for advanced technologies will become even more important. High efficiency clean coal technologies, for example, may be particularly important in protecting the earth's climate while continuing to allow the use of abundant coal supplies.

5) Increasing the benefits of R&D funds through cooperation with States and other countries

In his budget message, the President noted that "Considerable evidence exists that further increases in national R&D investment will enhance our productivity and brighten our future...In numerous instances States and localities are moving on their own, with their own funds to try new and innovative approaches to problem solving. This blossoming of State and local initiative is welcome." These comments provide support for FE's initiative to enter into competitive cooperative activities with States consistent with our mission.

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Cost-shared cooperation promotes leveraging of Federal, state and industrial funding to achieve national energy and environmental goals and is also an important tool for enhancing technology transfer to the private sector.

International cooperative activities can also play a beneficial role in leveraging FE R&D funds and ensuring that the U.S. remains in a technology leadership role. Collaborative international projects also promote U.S. presence in international markets which can facilitate future commercial technology sales.

The Clean Coal Technology Program

The Clean Coal Technology Program is a $5 billion, government-industry effort to demonstrate a variety of advanced, more efficient and environmentally responsive coal utilization technologies. These technologies will reduce or eliminate the economic and environmental impediments that limit the full use of coal. A series of "showcase" facilities are being constructed and operated across the country to demonstrate these improvements over conventional coal technology.

Technologies include new concepts for retrofitting improved pollution control equipment onto existing coal-burning power plants, new systems for repowering or replacing older electric generating facilities with advanced, high-efficiency clean power technology, and innovative approaches for producing clean-burning, coal-based fuel forms that can substitute for higher-value premium fuels.

The program requires at least 50 percent cost-sharing from industry and provides for recoupment of public investments from major commercial successes. To date, 38 projects are underway or in negotiation from the first three rounds of competition.

Prior Clean Coal Technology Funding Profile

($ in millions)

	1986	1987	1988	1989	1990	1991	1992
Round #1	$100	$150	$150				
Round #2			$ 50	$525			
Round #3					$575		
Round #4						$600	
Round #5							$600
	$100	$150	$200	$190	$710	$300	$600
			Special Envoys' Program				

Proposed Clean Coal Technology Funding Profile

($ in millions)

	1986	1987	1988	1989	1990	1991	1992	1993	1994
Round #1	$100	$150	$150						
Round #2*			$ 50	$190	$135	$200			
Round #3*					$419	$156			
Round #4						$100	$250	$250	
Round #5							$150	$225	$225
	$100	$150	$200	$190	$554	$456	$400	$475	$225
			Special Envoys' Program						

* Rounds #2 and #3 funding stretchouts were directed by Congress in FY89 and FY90

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The industrial cost-sharing for these projects has exceeded 60 percent. The Department is preparing for Round #4 competition, scheduled to begin on June 1, 1990.

As the chart on the previous page shows, the budget request proposes to spread funding for the remaining two rounds of Clean Coal Technology competition over several years rather than compressing the budgetary requirements in fiscal years 1991 and 1992. This action will *not* affect the pace of the program. It will *not* result in any fewer projects selected. In fact, it is consistent with previous Congressional funding patterns (which allocated the Administration's FY 1990 request for $575 million for Round #3 over two years and previously has allocated the FY 1989 Round #2 request for $525 million over three years.)

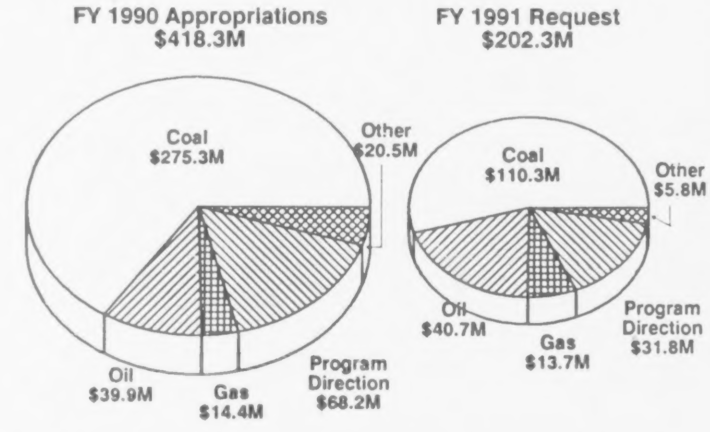
Selected clean coal technology projects, due to their multi-year duration and cost-sharing nature, receive federal funding over several years, typically over three to six years as design, construction and operation progresses. Consequently, the proposed new funding profile will not impact the program but will have significant deficit reduction benefits.

The Fossil Energy R&D Program

In contrast to the Clean Coal Technology Demonstration Program, the Fossil Energy R&D Program is oriented toward the initial stages of the development process -- i.e., the basic and applied research stages through the early stages of process engineering. The budget request for these activities is $202.3 million.

In carrying out this program, the Office of Fossil Energy, either through its headquarters or field centers, administers more than 500 individual research contracts, most carried out by industrial organizations or academic researchers. Within the FY 1991 budget proposal, priority has been given to programs and projects for which there is significant industry participation, either as a project participant or in many cases, as a project financial co-sponsor. In-house research, conducted principally at the Morgantown and Pittsburgh Energy Technology Centers as supporting research for the contract R&D projects, has been scaled back.

The FY 1991 budget also reflects a better balance between funding for coal and oil/gas research, as shown by the charts to the right. Given the near-term urgency of



In the FY 1991 request, Oil and Gas R&D comprise a larger funding share.

slowing the pace of oil field abandonments and increasing domestic oil production, the Department has earmarked 33 percent of its proposed FY 1991 research program budget (excluding Program Direction, Plant & Capital Equipment, and other non-research activities) for oil and gas related research, compared to only 17 percent in the FY 1990 appropriation.

FY 1991 Fossil R&D Budget Request – Summary Chart

Coal

Activity	Request
Control Technology & Coal Preparation	$33.5M
Advanced Research & Technology Development	26.5M
Coal Liquefaction	10.6M
Combustion Systems	17.6M
Fuel Cells	7.1M
Heat Engines	6.0M
Underground Coal Gasification	0.5M
Magnetohydrodynamics	0.0M
Surface Coal Gasification	8.5M
Total	$110.3M

Oil and Gas

Activity	Request
Advanced Extraction & Process Technology	$12.9M
Enhanced Oil Recovery	27.1M
Oil Shale	0.7M
Unconventional Gas Recovery	13.7M
Total	$54.4M

Other

Activity	Request
Fuels Programs	$ 2.7M
Environmental Restoration	0.7M
Program Direction	31.8M
Plant & Capital Equipment	2.4M

Coal

The FY 1991 budget request for coal research and development is $110.3 million. Within this budget request, priority has been given to technologies that can reduce the release of air pollutants, including sulfur dioxide, nitrogen oxide and particulates, in addition to carbon dioxide, one of the "greenhouse gases." Included in this priority are projects in *control technology and coal preparation, advanced research and technology development, combustion systems, fuel cells,* and *surface coal gasification.*

High efficiency concepts in *coal gasification, atmospheric* and *pressurized fluidized bed combustion*, *fuel cells* and *heat engines* are intended to provide options that can reduce the release of carbon dioxide.

Priority has also been given to technologies that potentially can open up new markets for coal and coal products. For example, programs to develop new *atmospheric fluidized bed combustors* and *alternative fuels* are directed at restoring the clean-burning coal option in light industrial, commercial and residential sectors. Programs geared to the transportation sector are found within the *coal liquefaction*, *surface coal gasification* and *heat engine* programs.

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Control Technology and Coal Preparation

	FY90 Request	FY90 Approps	FY91 Request	% Change
Advanced Research	$ 1.9	$ 2.1	$ 1.7	-23.8%
Coal Preparation	11.3	19.9	12.2	-38.7%
Flue Gas Cleanup	11.4	16.8	8.6	-48.8%
Gas Stream Cleanup	4.6	16.7	8.5	-49.1%
Waste Management	3.1	2.1	2.6	+23.8%
Total	$32.3	$57.6	$33.5	-41.8%

Numbers may not add due to rounding

Advanced Research, generic and fundamental in nature, is conducted on processes used to separate constituents such as sulfur and nitrogen oxides in coal fuel streams before, during and after combustion.

Coal Preparation is directed toward the development of advanced coal cleaning technologies that will reduce the ash and sulfur content of U.S. coal so that the product can be formulated into a high quality fuel that could replace oil and/or gas and reduce environmental emissions of acid rain precursors from coal-fired power plants in both new and retrofit applications. Research is conducted in three broad areas: (1) physical treatment and cleaning; (2) chemical/biological pretreatment and cleaning; and (3) ancillary operations.

Flue Gas Cleanup addresses the removal of polluting contaminants from fossil fuel fired systems to meet current and projected environmental standards that inhibit the utilization of fossil fuels. Efforts focus on processes for the combined removal of NOx, SOx; control of SO_2 emissions from utilities; NOx control; emissions control from small scale boilers; and fine particulate control technology.

Gas Stream Cleanup develops technologies for removal of contaminants from gasifier and combustor process streams prior to application in coal utilization systems. Both hardware and environmental protection are key concerns. Applications include PFB combustors, integrated gasifier combined cycle gas turbines, and direct coal-fired turbines.

Waste Management focuses primarily on waste sampling and characterization from coal preparation and emerging technology wastes.

	FY 1991 Request (in millions)
Advanced Research	
• Continue fundamental research on processes used to separate constituents in coal-based fuel streams before, during and after combustion. (FY 1990 - $2.1M)	$ 1.7
Coal Preparation	
• Continue laboratory and bench-scale investigations of microbial concepts for pyrite and organic sulfur removal. Continue supporting research in ancillary operations for all ranks of coal and support studies. Initiate bench scale investigations of advanced chemical techniques for producing clean coal products capable of	9.6

4c-9

	FY 1991 Request (in millions)
displacing oil and gas. Continue research on selected technologies for controlling emissions from pre-NSPS utility boilers (CCRI) to achieve the planned 1992 completion schedule. (FY 1990 - $9.8M)	
• Continue in-house research at bench scale to investigate advanced physical and chemical coal cleaning concepts. Continue organic sulfur chemistry. Maintain a data base, characterize feed coal and cleaned coal products. Continue program management support. (FY 1990 - $2.9M)	$ 2.6

Flue Gas Cleanup

• Continue research for TUNG scrubbing process. Participate in EPRI program of emissions control for electric power generating stations burning high-sulfur coals. Continue in-house research in spray dryer and in-duct technology development. Continue systems integration studies for low cost duct injection for moderate and high sulfur coals. (FY 1990 - $7.1M)	5.0
• Continue research on advanced NOx/SOx chemistry, processes, system modeling, and by-product recovery. Conduct data base support and technical and economic evaluation of processes. (FY 1990 - $2.4M)	1.0
• Continue advanced research on reburning, catalytic, and post combustion control concepts. Continue advanced concept development at larger scale. (FY 1990 - $2.5M)	1.1
• Continue development of advanced separation technology for SOx/NOx control. (FY 1990 - $0.8M)	0.2
• Continue larger scale tests of fine particulate control technology. Complete FY 1989 contract on enhanced mass transfer effect on sorbent utilization. Continue research on emissions control from small scale boilers. Initiate development of CO2 control technology. Continue program management support. (FY 1990 - $1.1M)	1.2

Gas Stream Cleanup

• For *Pressurized Fluidized-Bed Combustion*, assess feasibility of particle control and conduct follow-on research on barrier technical issues for particle control. (FY 1990 - $0.4M)	0.8
• For *Integrated Gasification Combined Cycle,* continue development of novel and enhanced sulfur sorbents. Continue novel fluidized bed cleanup system construction at the gasifier test facility. Continue design of joint project with industry for a particulate control test facility. (FY 1990 - $7.9M)	3.8
• For *Direct Coal-Fired Turbines,* continue development of acoustic enhanced combined sulfur/particulate removal. Carryout testing of cleanup equipment for METC combustor. Carryout granular bed	2.4

	FY 1991 Request (in millions)
filter tests and begin long term tests of selected concepts. (FY 1990 - $2.3M)	
• Continue membrane development. Continue development and testing of materials for ceramic candle and cross-flow filters. Conduct follow-on testing of novel particle control concepts. Fund program management support. (FY 1990 - $2.2M)	1.5

Waste Management

• Perform characterization of low rank coal waste and waste based liner materials development. (FY 1990 - $0M)	0.2
• Continue multi-site field monitoring of disposed wastes; characterization of wastes; waste-related data base maintenance; and program management support. (FY 1990 - $1.2M)	2.4

Advanced Research and Technology Development

	FY90 Request	FY90 Approps	FY91 Request	% Change
Coal Utilization Science	$ 3.5	$ 4.1	$ 3.3	-19.5%
Materials and Components	6.4	8.9	7.4	-16.9%
Technology Crosscut	11.8	7.7	10.4	+35.0%
University/National Lab Coal Research	3.8	5.7	5.4	-5.3%
Total	$25.5	$26.4	$26.5	+0.4%

The Advanced Research and Technology Development (AR&TD) Program's overall focus is on removing the inherent scientific and engineering barriers in generic technical areas that may hinder the development of all fossil energy technologies.

The *coal science* program focuses on fundamental research which will lead to coal utilization systems that offer substantial improvements in efficiency, reliability and environmental performance.

The *materials and components* program includes generic studies of materials, solid transport, and novel concepts to significantly improve the performance and cost of existing fossil systems or enable the development of new systems and enhanced capabilities.

The *technology crosscut* program undertakes management and scientific studies and research relating to several crosscutting areas relating to fossil fuel technologies.

The *University/National Laboratory Coal Research program* conducts basic research on coal science, reaction chemistry, advanced process concepts engineering fundamentals, thermodynamics, environmental sciences and high temperature phenomena.

Coal Utilization Science

	FY 1991 Request (in millions)
• Continue fundamental research on the properties of constituents and the nature of reactions in coal utilization processes. Investiga-	$3.3

	FY 1991 Request (in millions)
tions are made of the formation, transformation and characterization of fuel and combustion product species; coal devolatilization, pyrolysis and volatile and char oxidation; and radiant heat transfer. (FY 1990 - $4.1M)	
Materials and Components	
• *Components:* Continue activities to develop novel components for advanced coal conversion technologies. Continue fundamental research on solid transport to include research on the Granular Flow Advanced Research Objective (GFARO) and exploratory research on multiphase flow. (FY 1990 - $2.5M)	1.3
• *Materials:* Continue research on structural ceramic composites, advanced austenitic alloys, ceramic filters, iron aluminides, coatings and claddings, ceramic membranes, ceramic catalyst supports, mechanisms of erosion and corrosion, solid state electrolyte materials, technology transfer and new ceramic materials processes. (FY 1990 - $6.4M)	6.1
Technology Crosscut	
• *Environmental Activities:* Continue analyses of issues associated with air and water quality, solid waste disposal, and toxic substances. Continue support of occupational health, quality assurance, and safety compliances services. (FY 1990 - $2.4M)	2.2
• *Technical & Economic Analyses:* Continue studies supporting FE multi-year planning and program formulation; conduct contract studies that crosscut a number of FE programs, including strategic benefits of new fossil fuel technology; provide technical and economic analytical support. (FY 1990 - $1.8M)	2.1
• *International Program Support:* Continue to conduct analyses, studies and technical evaluations of ongoing and planned bilateral and multilateral activities. Fund selected activities of the International Energy Agency. (FY 1990 - $0.7M)	1.0
• *Coal Technology Export:* Provide support for coal and coal technology export opportunities and initiatives. (FY1990 - $0.2M)	2.0
• *Instrumentation and Diagnostics:* Continue studies to measure acoustic parameters of fluids in multiphase flow, and research on laser-based chemical species analysis, particle species and size determinations. Continue sensor development for the harsh environments of coal conversion processes. Increase study of "expert" instrumentation system applications to coal utilization. Continue coordinating activities for all Fossil Energy instrument-related projects. Conduct research on an instrument to measure	1.7

FY 1991 Request
(in millions)

the opacity of gas downstream of a barrier filter used to control erosion of turbine components. (FY 1990 - $1.5M)

- *Bioprocessing of Coal:* Expand research on coal bioprocessing, including work on: identification of more effective microbes and enzyme systems for bioconversion of coal, bioprocess engineering and related molecular genetics, and evaluation of thermophiles (i.e., organisms that function between 45 and 100 degrees C) for removal of sulfur, nitrogen and ash from coal. (FY 1990 - $1.0M) 1.4

University/National Laboratory Coal Research

- Support approximately 26 new grants at U.S. colleges and universities for basic research on coal science, coal surface science, reaction chemistry, advanced process concepts, engineering fundamentals and thermodynamics, environmental sciences and high temperature phenomena. Support 3-5 competitively determined research grants at Historically Black Colleges and Universities (HBCUs). (FY 1990 - $5.7M) 5.4

Coal Liquefaction

This program is developing advanced technology to produce synthetic liquid fuels from coal. The focus is on two approaches: *direct liquefaction* and *indirect liquefaction*.

The major funding reductions in this budget category are associated with the successful completion of tests at two process development units: the Wilsonville, AL, direct liquefaction facility, where tests of advanced integrated two-stage liquefaction have shown the potential for reducing the costs of coal liquids to the equivalent of $35 per barrel (from an estimated cost of more than $70 per barrel in the late-1970s); and the LaPorte, TX, liquid phase methanol synthesis development unit, where successful test runs have provided the basis for scale up of the process at the Great Plains Coal Gasification Plant under a cost-shared Clean Coal Technology project. Funding has also been elminated for generic bench scale activities at the Pittsburgh Energy Technology Center.

	FY90		FY91	%
	Request	Approps	Request	Change
Advanced Research	$ 3.1	$ 6.6	$ 2.9	-56.1%
Direct Liquefaction	2.9	17.7	4.5	-74.6%
Indirect Liquefaction	2.7	8.5	2.4	-71.8%
Support Studies/ Engineering Eval.	1.0	1.7	0.8	-52.9%
Total	$ 9.7	$34.5	$10.6	-69.3%

FY 1991 Request
(in millions)

Advanced Research

- Continue research on: novel catalytic, biological and other approaches to coal liquefaction; improving the understanding of li- $2.9

	FY 1991 Request (in millions)
quefaction. Continue to fund technical and program management support. (FY 1990 - $6.6M)	
Direct Liquefaction	
• Continue PETC in-house research and laboratory research in co-processing, staged catalytic liquefaction and advanced process concepts. (FY 1990 - $17.7M)	4.5
Indirect Liquefaction	
• Continue laboratory research at PETC. Continue laboratory research with industry and universities on oxygenate fuel process concepts. Continue novel catalyst research. (FY 1990 - $8.5M)	2.4
Support Studies/Engineering Evaluations	
• Maintain process stream characterization research for advanced coal liquefaction and co-processing processes. Continue novel catalyst development and process studies at Sandia National Lab. (FY 1990 - $1.7M)	0.8

Combustion Systems

	FY90		FY91	%
	Request	Approps	Request	Change
Advanced Research	$ 1.2	$ 2.4	$ 2.2	-8.3%
Atmospheric Fluidized Bed Combustion	1.7	3.0	1.2	-60.0%
Pressurized Fluidized Bed Combustion	6.6	12.6	7.5	-40.5%
Advanced Combustion	2.6	5.5	3.7	-32.7%
Alternative Fuels Utilization	3.7	9.7	3.0	-69.1%
Total	$15.8	$33.2	$17.6	-47.0%

The Department of Energy has developed a program to increase the contribution and application of the nation's coal resources through the development of acceptable combustion systems and fossil-derived fuels for the marketplace.

First-generation *atmospheric fluidized bed combustion technology* is considered commercial for large industrial boiler applications (200,000 lb/hr steam and greater). Therefore, the Fossil Energy R&D program is aimed at extending the applicability of this technology to light industrial, commercial/institutional and possibly, residential sectors.

Similar target sectors are also being pursued in the *Advanced Combustion Technology Program.* The slagging combustors available in the near-term lend themselves most economically to the heavy industrial and utility markets; the Fossil Energy program is improving the industrial/utility concepts and extending the technology into the light industrial, commercial and residential markets.

Pressurized fluidized bed combustion is intended primarily as a utility power generating option. The first commercial-scale units are being installed in the U.S. in the Clean Coal Technology Program; thus, the Fossil Energy R&D program is concentrating on "second-generation" pressurized fluidized bed concepts.

Alternative fuels include raw or beneficiated coal, either pulverized or ultrafine; other solid coal-based fuels, either dry or in slurry form; and chars and liquids from coal conversion and stabilization processes.

	FY 1991 Request (in millions)
Advanced Research	
• Continue generic studies to examine the fundamental aspects of combustion mechanisms, engine combustion design, corrosive behavior and deposition of combustion products. (FY 1990 - $2.4M)	$2.2
Atmospheric Fluidized Bed Combustion	
• Continue to conduct in-house experimental and analytical erosion studies and AFBC development efforts. (FY 1990 - $0.5M)	0.4
• Continue proof-of-concept testing within the Advanced Concepts Program. (FY 1990 - $0.5M)	0.4
• Continue development of subsystem integration technology within the Special Applications Program. (FY 1990 - $1.5M)	0.3
• Continue low rank coal studies at UNDEERC. (FY 1990 - $0.1M)	0.1
Pressurized Fluidized Bed Combustion	
• Continue research efforts at METC on PFB dynamics, systems analysis and combustion characterization. (FY 1990 - $1.1M)	0.9
• Continue Advanced Concepts Phase III integrated subsystem tests at 5MWe pilot plant scale. (FY 1990 - $4.3M)	5.1
• Initiate construction of Hot Gas Clean-up Filter Test Facility at TIDD PFB Demo Plant. (FY 1990 - $5.9M)	1.4
• Fund technical and program management support. (FY 1990 - $0.1M)	0.1
Advanced Combustion Technology	
• Continue development of the most promising advanced combustion systems for industrial, utility, commercial and residential applications. (FY 1990 - $3.6M)	1.6
• Continue in-house activities on combustion enhancement and pollution suppression research including data base development for technology transfer to the private sector. Continue to provide technical and program management support. (FY 1990 - $1.0M)	1.1
• Continue advanced high efficiency cycles for CO_2 reduction. (FY 1990 - $1.0M)	1.0

	FY 1991 Request (in millions)
Alternative Fuels Utilization	
• Continue fuel characterization and boiler tests of beneficiated coal-leased fuels. Continue transport, handling and storage studies, and combustion characterization of beneficiated coal based fuels. Continue project management support. Assess and test deeply beneficiated coals for retrofitting large pre-NSPS coal-fired boilers for acid rain control. Provide technical and program management support. (FY 1990 - $5.5M)	$3.0

Fuel Cells

The objectives of the Fuel Cells program are to support technology base development of fuel cell systems and to provide technology that improves U.S. international competitiveness by generating export sales for technology/products.

	FY90 Request	FY90 Approps	FY91 Request	% Change
Advanced Research	$ 1.0	$ 1.4	$ 0.4	-71.4%
Phosphoric Acid Sys.	0.0	8.3	0.0	-100.0%
Molten Carbonate Sys.	3.4	16.8	5.7	-66.1%
Advanced Concepts	2.1	11.5	1.0	-91.3%
Total	$ 6.5	$38.0	$ 7.1	-81.3%

Advanced research, fundamental and generic in nature, is conducted to better understand the basis of the underlying processes involved in fuel cell operation and to explore novel concepts and advanced materials.

Phosphoric acid systems have reached a prototype commercial status. The IFC development effort is fully funded through its scheduled 1992 completion date. DOE believes that any further technology development should be the responsibility of the private sector.

The technical feasibility of *molten carbonate fuel cells* operating at approximately 60 percent electrical conversion efficiency (natural gas to busbar) has been forecast by single cell testing. The complexity and associated capital costs of advanced fuel cell systems are projected to be less than those for first generation phosphoric acid fuel cell systems.

The *solid oxide fuel cell* is an advanced, high temperature solid state fuel cell that offers promise in electric utility and in cogeneration applications in industrial and commercial sectors.

	FY1991 Request (in millions)
Advanced Research	
• Continue generic research in molten carbonate fuel cell electrochemistry. (FY 1990 - $1.4M)	$0.4
Molten Carbonate Systems	
• Continue two cost-shared MCFC system/stack contracts selected under the FY 1990 competitive action. (FY 1990 - $16.5M)	5.6
• Continue development of alternate anode materials, and program management support. (FY 1990 - $0.3M)	0.1

	FY 1991 Request (in millions)
Advanced Concepts	
• Continue cost-shared development of tubular solid oxide fuel cell (SOFC) technology for coal-fueled applications. (FY 1990 - $8.9M)	0.9
• Continue gasification/SOFC systems analysis and materials development. Continue program management support. (FY 1990 - $2.6M)	0.1

Heat Engines

	FY90 Request	FY90 Approps	FY91 Request	% Change
Gas Turbines	$ 6.5	$10.4	$ 3.0	-71.2%
Diesel Engines	2.4	10.5	3.0	-71.4%
Total	$ 8.9	$20.9	$ 6.0	-71.3%

The principal goals of this program are to ensure the strategic security of liquid and gas supplies and to provide technology and technology-based products that improve U.S. international competitiveness by generating export sales for technology/products. Successful development of coal-fueled heat engines could provide an alternative to oil-fueled systems in industrial cogeneration, locomotive, marine and utility applications.

The program focuses on overcoming the technical problems associated with the combustion, corrosion, deposition, wear and particulate control when burning dry, slurried or gaseous fuels in turbines and diesels.

	FY1991 Request (in millions)
Gas Turbines	
• Continue coal-fueled gas turbine integrated systems testing with one contractor instead of three in FY 1990 (FY 1990 - $7.7M)	$2.1
• Continue pressurized coal combustion testing, systems analyses, and program management support. (FY 1990 - $2.7M)	0.9
Diesel Engines	
• Continue coal-fueled diesel engine integrated system development with one contractor instead of two; continue novel concept project. Continue combustion testing and systems analysis, low-rank coal activities, and program management support. (FY 1990 - $10.5M)	3.0

Underground Coal Gasification

This program supports the development of viable technology for in situ conversion of coal to a cleaner burning, easily transportable gaseous fuel. Program efforts are directed toward the definition of technical, operational, and environmental parameters sufficient to allow industry to make decisions concerning the commercial development of the technology.

	FY90 Request	FY90 Approps	FY91 Request	% Change
Technology Develop.	$ 0.2	$ 0.2	$ 0.3	+50.5%
Environmental and Advanced Research	0.2	0.6	0.2	-66.7%
Total	$ 0.4	$ 0.8	$ 0.5	-37.5%

	FY 1991 Request (in millions)
Gasification Technology Development	
• Continue cooperative research efforts with WRI (FY 1990 - $0.2M)	$0.3
Environmental and Advanced Research	
• Continue environmental compliance, restoration, and reclamation activities at historical UCG test sites as required by law, (FY 1990 - $0.6M)	0.2

Magnetohydrodynamics (MHD)

The current FY 1990 MHD program continues the proof-of-concept (POC) program which is based on the Department's June 1984 Coal-Fired MHD Preliminary Transition and Program Plan. Since FY 1986, the Congress has included specific private sector cost-sharing requirements for the POC program in its annual appropriations bills. This program will provide the design basis for the development of components and subsystems and is aimed at furnishing the technology base for integrated, long duration, POC testing. Long duration POC testing is needed for the advancement of the MHD technology to the retrofit demonstration stage which is a necessary pre-requisite for subsequent commercial application.

	FY90 Request	FY90 Approps	FY91 Request	% Change
Proof of Concept Topping Cycle	$ 0.0	$25.4	$ 0.0	-100.0%
Proof of Concept Bottoming Cycle	0.0	9.0	0.0	-100.0%
Proof of Concept Seed Regeneration	0.0	2.5	0.0	-100.0%
Systems Studies, Spt. Research, Concep. Des.	0.0	3.5	0.0	-100.0%
Total	$ 0.0	$ 40.4	$ 0.0	-100.0%

	FY 1991 Request (in millions)
• Since it is estimated that $92 million (in 1988 dollars) is needed to complete POC testing, the Department believes that the cost of continuing its MHD program is not affordable in light of current fiscal constraints and in light of the development of other high efficiency techniques. (FY 1990 - $40.4M)	$0.0

Surface Coal Gasification

This program is organized to foster the development of advanced gasifier systems for the production of: electric power, synthesis gas (for synthetic natural gas, indirect liquefaction and chemical feedstocks), and coproducts (production of solids, liquids, and gases).

	FY90 Request	FY90 Approps	FY91 Request	% Change
Advanced Research	$ 0.7	$ 2.6	$ 0.5	-80.8%
Systems for Power Production	1.2	6.3	3.7	-41.3%
Systems for Industrial Fuel Gas Production	0.8	0.9	0.0	-100.0%
Systems for Synthesis Gas Production	1.1	1.7	1.1	-35.3%
Systems for CoProducts Production	4.9	11.9	3.2	-73.1%
Total	$ 8.7	$23.4	$ 8.5	-63.7%

This activity also provides for basic and fundamental research related to surface coal gasification processes including studies of reaction mechanisms and chemistry.

	FY 1991 Request (in millions)
Advanced Research	
• Continue coal gasification system assessment and modeling effort, studies of ash and slag characteristics, and precursor properties of condensible hydrocarbons (FY 1990 - $1.0M)	$0.5
Systems for Power Production	
• Continue METC in-house sulfur kinetic studies, efforts on fixed-bed and fluidized bed gasifiers and technical and program management support. (FY 1990 - $2.1M)	1.8
• Expand test program to develop a data base needed for commercialization of the GE gasifier cleanup system. (FY 1990 - $1.2M)	0.5
• Continue development and testing of hot desulfurization in an entrained flow reactor system for an IGCC demonstration. (FY 1990 - $1.4M)	1.4
Systems for Industrial Fuel Gas Production	
• The Industrial Fuel Gas production program will be phased out in FY 1991 and related research continued in other Surface Coal Gasification programs. (FY 1990 - $0.9M)	0.0
Systems for Synthesis Gas Production	
• Conduct transportation fuels study. (FY 1990 - $0.0M)	0.2
• Develop hydrogen preparation concepts. (FY 1990 - $0.5M)	0.3

	FY 1991 Request (in millions)
Continue systems analysis and model development efforts. Provide technical and program management support. (FY 1990 - $0.6M)	$0.6

Systems for Coproducts Production

Conduct mild gasification studies to establish a matrix of product yields and investigate product options for coal-based fuels from mild gasification. (FY 1990 - $9.1M)	0.8
Upgrade mild gasification plant to 1 ton/hr capability. (FY 1990 - $1.0M)	1.0
Initiate studies to improve mild gasification product. (FY 1990 - $0.0M)	0.2
Continue fuel upgrading R&D (FY 1990 - $0.4M)	0.5
Continue modeling analysis and system analysis. Provide technical and program management support. (FY 1990 - $0.3M)	0.7

Petroleum and Gas

Extraction technology strategies to increase domestic oil and gas supplies include programs in enhanced oil recovery, unconventional gas recovery, oil shale and advanced extraction and process technology. In contrast to prior years, the Petroleum and Gas R&D program in FY 1991 proposes a much *nearer-term* strategy focused on identifying and maintaining economic access to high potential, high risk oil reservoirs and the development of a more complete data base of both conventional and unconventional natural gas resources.

The program also includes a mid-term strategy that emphasizes the use of advanced technology to maximize recovery effectiveness from oil and gas reservoirs, and a long-term strategy that seeks to improve basic understanding of oil reservoirs and develop so-called "speculative" natural gas resources.

Advanced Extraction & Process Technology

The Advanced Extraction and Process Technology (AEPT) Program pursues new concepts to achieve major increases in efficiency and cost reduction of recovery and upgrading techniques for oil, gas, and oil shale.

	FY90 Request	FY90 Approps	FY91 Request	% Change
Fundamental Geoscience and Extraction Research	$ 1.5	$ 2.8	$ 7.4	+164.3%
Supporting Technology and Environ. Research	3.1	0.8	4.2	+425.0%
University Geoscience Research	0.0	0.0	1.3	+100.0%
Total	$ 4.6	$ 3.6	$ 12.9	+258.3%

The goals of this research program are: to conduct fundamental research relevant to recovery and upgrading of oil, gas and oil shale; to pursue application of discoveries from unexplored new concepts which may achieve major increases in the recovery and upgrading of oil, gas and oil shale resources.

The Fossil Energy Office in FY 1991 will initiate geotechnology research based on the Hydrocarbon Geoscience Research Strategy and the detailed Oil and Gas Implementation Plan jointly funded with consortia of states, industry, and universities. The program will be based on competitive procurement of appropriate performers for major parts of the implementation. It is anticipated that this initiative will more align oil and gas R&D with the nearer term needs of the nation, will obtain greater cost-sharing by the private sector, and will facilitate technology transfer to the private sector. The AEPT program will support this initiative through research to overcome barriers to recovery identified by the Enhanced Oil Recovery and Unconventional Gas programs. Associated tasks in the Advanced Extraction and Process Technology program include reservoir description R&D; extraction and engineering R&D; and environmental and related R&D and technology transfer.

	FY 1991 Request (in millions)
Fundamental Geoscience and Extraction Research	
• Continue existing research on geoscience and extraction technology and development of advanced instrumentation to measure reservoir characteristics and thermal fronts. Explore novel extraction and production methods for oil, gas, shale oil, and tar sands liquids; continue research to develop theory, instrumentation, and predictive models to determine reservoir heterogeneities and relate this information to the production and recovery of bypassed oil and gas. (FY 1990 - $2.8M)	$4.3
• Initiate cost shared funding of geotechnology research consortia with states, universities and private industry in supporting technology associated with the Geoscience Strategy and the Oil and Gas Implementation Plan. (FY 1990 - $0.0M)	3.0
• Fund technical and program management support. (FY 1990 - $0.03M)	0.1
Supporting Technology and Environmental Research	
• Increase the program of fundamental studies including crosscutting research in petroleum chemistry focusing on structural characterization and determination of a structure-property relation of heavy crude, intermediate product stream, product, and byproduct, coprocessing, gas processing, and biotechnology. Fund technical and program management support. (FY 1990 - $1.0M)	4.2

University Geoscience Research

	FY 1991 Request (in millions)
• Continue funding third year PRDA program of university-based, fundamental research to advance oil and gas extraction. Fund technical and program management support. (FY 1990 - $0M) *Note: This item was funded in Fundamental Geoscience and Extraction Research in FY 1990.*	$1.3

Enhanced Oil Recovery

	FY90		FY91	%
	Request	Approps	Request	Change
Light Oil	$14.2	$22.5	$22.5	0.0%
Heavy Oil	4.1	4.0	4.6	+15.0%
Tar Sands	0.0	0.9	0.0	-100.0%
Total	$18.3	$27.4	$27.1	-1.1%

Enhanced oil recovery (EOR) can help sustain domestic oil production in the critical period between now and the time when the nation will likely rely more extensively on synthetic and renewable fuels. The program is addressing the near-term problems of maintaining access to currently producing marginal fields and is targeting research on specific, high priority resource classes. It is also developing advanced techniques that can maximize recovery. In FY 1991, a regional/reservoir research program jointly funded with consortia of states, industry and universities will be initiated.

Light Oil

	FY 1991 Request (in millions)
• Continue research in light oil recovery techniques and conduct related planning, technical and analytical assessment, and program management support to classify and prioritize resource targets and research activities (FY 1990 - $4.4M)	$3.4
• Initiate a key regional/reservoir research program jointly funded with consortia of state, industry, and universities. (FY 1990 - $0M)	10.0
• Continue a geoscience effort and reservoir characterization and related fundamental studies addressing definition of reservoir structure and composition. (FY 1990 - $9.3M)	4.8
• Initiate a program to understand the environmental impacts associated with light oil recovery operations. (FY 1990 - $0M)	0.7
• Provide support for a MEOR conference and continue thermophylic bacteria recovery efforts. (FY 1990 - $2.7M)	0.3
• Continue the industry/state cooperative effort. Conduct a technology transfer program to include meetings, workshops and extension service offices. Continue the National Laboratory/industry partnership program. (FY 1990 - $2.8M)	3.3

Heavy Oil

	FY 1991 Request (in millions)
• Continue basic research in mobility control mechanisms and alkaline flooding. Initiate an alkaline flood test. (FY 1990 - $1.6M)	$1.5
• Conduct a study to identify resource targets and conduct related planning and analytical assessment studies. Conduct a technology transfer program to include workshops, extension service offices, and a summer intern program. (FY 1990 - $0.5M)	0.9
• Continue fundamental research on reservoir and fluid properties (FY 1990 - $1.1M)	0.4
• Initiate an environmental impact program for heavy oil. (FY 1990 - $0M)	0.8
• Continue a geoscience characterization program, research in novel extraction approaches to presently deemed unrecoverable, heavy oil resources, and fundamental studies of reservoir characteristics and injection fluid interactions. Provide program support. (FY 1990 - $0.9M)	1.0

Oil Shale -

	FY90 Request	FY90 Approps	FY91 Request	% Change
Technology Base	$ 1.0	$ 6.7	$ 0.7	-90.0%
Environmental Mitigation	0.7	2.3	0.0	-100.0%
Total	$ 1.7	$ 9.0	$ 0.7	-92.2%

Oil shale technology development involves the development of extraction and conversion processes designed to convert oil shale to various liquid fuels. The program focuses on basic research to systematically study the chemistry, kinetics, and emissions related to eastern and western shale processing. The FY 1991 proposes to reduce funding for oil shale research in favor of more near-term, urgent priorities in the petroleum program. Basic research in oil shale properties is continued with engineering work on retorting and related process-related effort being postponed for the present time.

	FY 1991 Request (in millions)
Oil Shale Technology Base	
• Continue funding for WRI to perform characterization of reference shales. (FY 1990 - $6.7M)	$ 0.7
Environmental Mitigation	
• No activity. (FY 1990 - $2.3M)	0.0

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Unconventional Gas Recovery

	FY90 Request	FY90 Approps	FY91 Request	% Change
Eastern Gas Shales	$ 0.3	$ 3.2	$ 2.7	-15.6%
Western Tight Sands	0.3	3.5	3.0	-14.3%
Environmental and Advanced Research	3.5	7.7	8.0	+3.9%
Total	$4.1	$14.4	$13.7	-4.9%

This program develops advanced technologies to extract natural gas from currently unrecoverable gas resources by reducing the uncertainty in the magnitude of the gas resources and the conditions under which they can be produced.

In FY 1991, the program will initiate jointly funded research with a consortia of states, industry and universities to develop a natural gas data system and a classification scheme for conventional gas reservoirs.

	FY1991 Request (in millions)
Eastern Gas Shales	
• Continue in-house support and update the predictive models associated with reservoir and stimulation performance; continue systems studies in support of production strategies; complete field tests for gas production in multiple strata; conduct fractured reservoir mapping studies; and complete horizontal drilling/production tests. (FY 1990 - $3.2M)	$2.7
Western Tight Gas Sands	
• Complete extrapolation of multi-well results to other areas of gas potential. Continue studies on developing concepts for the origin of natural fractures in tight sand basins. Complete stimulation of slant/horizontal well. (FY 1990 - $3.5M)	3.0
Environmental and Advanced Research	
Speculative Resources	
• Continue in-house geologic, geophysical and geochemical efforts to study deep source gas generation potential in subduction zones and associated sediments. (FY 1990 - $0.2M)	0.3
• Continue research on geological/geochemical studies on origin and mitigation of gas in deep sedimentary basins. (FY 1990 - $0.5M)	0.5
Conventional Resources	
• Establish and develop diagnostics for evaluating and characterizing natural and induced fractured gas reservoirs. (FY 1990 - $0)	1.5

	FY 1991 Request (in millions)
• Initiate development of a natural gas data system for both unconventional and conventional reservoirs. Initiate development of a gas classification system for conventional reservoirs based on depositional environments and recovery efficiencies. This research will be jointly funded with consortia of states, industries and universities. (FY 1990 - $0)	$4.0
• Initiate effort to improve economics of air-drilled horizontal wells through improvements in drilling and completion techniques. (FY 1990 - $0)	1.0
• Complete secondary gas recovery project. (FY 1990 - $3.0M)	0.7

Fossil Energy Environmental Restoration

In May 1983, the Pittsburgh and Midway Coal Mining Co. (P&M), the DOE contractor/operator of the Ft. Lewis Coal Liquefaction Pilot Plant (Tacoma, Washington), was notified by EPA that they were potentially liable along with hundreds of others for cleanup of the Western Processing Site. DOE, P&M and others agreed to pay the costs of cleaning up the site and a trust fund was established to receive and disburse payments.

Total site cleanup (Phase I/Surface and Phase II/Subsurface) was estimated to be a minimum of $40 million. Currently, cleanup is in Phase II and monitoring will not be complete until the year 2020.

In May 1988, the Laramie Project Office received a Notice of Violation from the Wyoming Department of Environmental Quality. As a result, DOE has agreed to assist in the cleanup of the groundwater contaminated by hydrocarbons at the Rock Springs, Oil Shale retorting site. Cleanup of the Rock Springs site includes groundwater sampling and analysis, pumping and water treatment, well abandonment and reseeding.

As a result of the DOE environmental survey that was conducted in February, 1989; it was found that two FE Surface Coal Gasification research PDUs at the Rockwell International Site (Calif.) required cleanup of hazardous materials. Government owned property accountable under the contract is contaminated with hazardous materials including tars, heavy oils, and asbestos generated during the conduct of R&D at the Rockwell Site. Also discovered during clean-up was asbestos insulation on piping and a 150 foot underground contaminated line.

	FY 1991 Request (in millions)
• Continue to fund DOE share of Ft. Lewis trust fund Phase II cleanup of Western Superfund site. (FY 1990 - $1.0M)	$0.2
• Continue cleanup of the Rock Springs site using prior year funds. (FY 1990 - $0.0M)	0.0
• Fund cleanup of hazardous materials at the Rockwell International site. (FY 1990 - $0.0M)	0.5

Fuels Programs

	FY90 Request	FY90 Approps	FY91 Request	% Change
Fuels Programs	$2.7M	$2.7M	$2.7M	0%

The Office of Fuels Programs is responsible for regulating natural gas imports and exports, transmission facilities for electricity imports, electricity exports, and implementing the Powerplant and Industrial Fuels Use Act. The Office also develops trade policy for natural gas and electricity.

	FY 1991 Request (in millions)
• Provide funding for the regulation of natural gas imports and exports, electric import transmission facility certification, electricity export authorization, and implementation of the Powerplant and Industrial Fuel Use Act; and the development of natural gas and electricity trade policy (FY 1990 - $2.7M)	$2.7

Program Direction

	FY90 Request	FY90 Approps	FY91 Request	% Change
Headquarters Program Direction	$ 9.1	$ 16.2	$ 9.9	-38.9%
ETC Program Direction	16.5	51.8	21.6	-58.3%
Federal Inspector for the Alaskan Natural Gas Transportation System	0.2	0.3	0.3	0.0%
Total	$25.8	$68.3	$31.8	-53.4%

This activity provides funding for salaries, benefits and overhead expenses for the management of FE programs at Headquarters, the Energy Technology Centers, the Bartlesville Project Office, and the Metairie Site Office.

The Headquarters element has overall program responsibility which is accomplished through the development and implementation of policy, establishment of program objectives and by monitoring the performance of work conducted at the field offices.

The Bartlesville Project Office, Metairie Site Office and the Energy Technology Centers (ETCs) support day-to-day project management functions for assigned programmatic areas including performing such in-house research program activities as contract and National Laboratory monitoring, development and maintenance of project, budget and procurement plans, and other activities related to program and site support.

The Office of the Federal Inspector for the Alaskan Natural Gas Transportation System is responsible for coordinating all Federal activities pertaining to the construction and initial operation of the pipeline. The Office of the Federal Inspector also enforces federal laws and permits, and monitors activities that affect the system.

	FY 1991 Request (in millions)
Headquarters Program Direction	
• Provide funds for salaries and benefits of 123 FTEs at Headquarters. This staff implements and communicates policy to the ETCs, sets program objectives, develops program plans and evaluates alternative strategies; develops and defends budget requests; approves procurement plans, monitors work programs. (FY 1990 - $9.1M)	$8.7
• Fund travel in support of the activities stated above. Both domestic and international travel is conducted. (FY 1990 - $0.7M)	0.5
• Provide contractual services that are generic to the entire FE program. Included are items such as printing, computer services, technical support services, conferences, etc. (FY 1990 - $6.4M)	0.8
ETC Program Direction	
• Fund salaries and benefits of the ETC staff of 296 FTEs. Activities of the staff include contract and lab monitoring; development and maintenance of project, budget, and procurement plans, and other activities related to program and site support. (FY 1990 - $20.4M)	16.3
• Fund travel in support of the coordination of the above activities in the attainment of program goals, both of the domestic front and abroad. (FY 1990 - $1.0M)	1.1
• Fund facility operations, maintenance, finance and administrative contractors and other costs not appropriately chargeable to R&D projects, in support of this level of FTEs. (FY 1990 - $30.4M)	4.2
Federal Inspector for the Alaskan Natural Gas Transportation System	
• Fund administrative and support functions; continue to assess developments in U.S. and Canadian energy markets and maintain liaison with project sponsors, producers, other government agencies, State of Alaska and Canadian government. (FY 1990 - $0.2M)	0.3

Plant and Capital Equipment

	FY90		FY91	%
	Request	Approps	Request	Change
Capital Equipment	$ 0.0	$ 1.5	$ 1.3	-13.3%
Construction	1.9	10.5	1.1	-89.5%
Total	$ 1.9	$12.0	$ 2.4	-80.0%

Capital equipment is purchased to replace obsolete equipment so that the ETCs and the

National Laboratories analytical capabilities are constantly being upgraded. General plant projects are essential to the safe, efficient operation of the ETCs and construction is dedicated to a number of improvement, alterations and additions at each of the ETCs.

	FY 1991 Request (in millions)
Capital Equipment	
• Provide centralized funding for capital equipment needs at the ETCs, National Labs, and BPO. (FY 1990 - $0.5M)	$0.5
• Provide funding for additional computing capacity at Pittsburgh ETC to support new activities that include business and technical modeling, cost/price and financial analysis and tracking of contract deliverables. (FY 1990 - $1.0M)	0.7
Construction	
• Provide for General Plant Projects (GPP) at the ETCs and BPO. (FY 1990 - $1.8M)	0.5
• Continue construction of the program support facility at PETC. (FY 1990 - $3.0M)	0.7

INTRODUCTION OF ASSOCIATES

Mr. **Gentile**. Thank you, Mr. Chairman. To my left is Jeremiah Walsh, my Deputy Assistant Secretary for Management, Fundamental Research and Cooperative Development. To my immediate right is Mr. Rick Furiga, the Deputy Assistant Secretary for Petroleum Reserves. On my far right is Mike McElwrath, the Principal Deputy Assistant Secretary. Behind me I have other staff members who, with the Chairman's permission, I'd like to call upon to answer specific questions if needed.

Moving into just some brief comments, I would like to submit my more formal statement into the record. I have some brief comments, however, regarding the budget.

CLEAN COAL TECHNOLOGY

In the area of clean coal, our budget request for the Clean Coal Technology Program is $456 million. It includes the last increment of funding for Rounds Two and Three and the first year of funding for Round Four. The major distinction in this budget compared to the FY 1990 Clean Coal Technology budget is a stretch out of the budget authority for Rounds Four and Five.

Let me stress, Mr. Chairman, that this will not adversely affect either the pace or the scope of the Clean Coal Technology Program. We will select the same number of projects and the same time period as we would have had the entire funding for Rounds Four and Five been compressed into 1991 and 1992.

Mr. Chairman, I might say that since I've joined the Department, I've gained a greater appreciation for the magnitude of the Clean Coal Technology Program, as well as for its importance to this country. Even though some projects have been forced to withdraw, others are proceeding on schedule and are beginning to produce results.

On the balance, I can report to you that the program is sound. Since the steps taken by Secretary Watkins to accelerate our internal administrative process were taken, we are seeing the pace of contract negotiations and approvals quicken. We have 38 projects either underway or in negotiation at the present time. By February 1 of next year, we expect to add another 10 to 15 projects for the fourth round of competition.

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

The Fossil Energy Research and Development budget request is $202.3 million. I recognize that this is a significant reduction from the Congressionally-appropriated amount for FY 1990, but I would hope that the Committee would not look at this simply as an arbitrary cutting of programs. Within the funding constraints we are working under, the Department has attempted to construct a budget that reflects our highest priority efforts. For example, you will find shifts within all of our programs toward nearer-term priorities—research that we believe could help in the next few years rather than the next century.

You will see many efforts in our Coal Program that undergird the Clean Coal Program, projects that ultimately could offer further improvements to the advanced control technologies now in the demonstration phase. You will see the beginnings of new efforts to concentrate on high efficiency systems as a way to reduce CO_2 buildup.

Mr. Chairman, you will also see a very clear recognition of the liquids problem facing this country in terms of rising imports and falling domestic production. You will see that we have requested a substantial boost in our Oil and Gas Program over the Administration's request of last year or, for that matter, the requests of the last eight years.

The budget represents our belief that we can do the most good, in the shortest timeframe, and in the most economical fashion by finding ways to keep domestic oil wells producing. Well abandonment is an immediate problem in this country, and it is a problem that is going to get steadily worse in this decade even if oil price trends continue upward.

Programs like Oil Shale, Tar Sands, and even Coal Liquefaction are important to this country. Their importance will increase in the future. This budget emphasizes programs that address an immediate problem, namely falling domestic oil production. We are targeting much of our funding, particularly in the oil and gas area, on projects that can produce commercial results in one to five years.

Mr. Chairman, we have no argument with this Committee that there could be more good projects than could possibly be funded. Our task is to take the dollars available and apply them where they will do the most good. I believe this budget does that. It maintains a solid core level of research in the coal area. Coupled with the Clean Coal Technology Program, it will keep coal a part of our energy fixture for well into the future.

I believe this budget reflects the sound approach we are addressing in the near-term liquids problem in this country, both with restructured program priorities and with sufficient funding to carry them out.

STRATEGIC PETROLEUM RESERVE

Turning to the Strategic Petroleum Reserve, our Strategic Petroleum Reserve budget asks for a new budget authority of $228.4 million. By itself, that equates to a fill rate of about 39,000 barrels per day, though we will add to it carryover from the previous year and the excepted revenues for NPR product sales, in which revenues are in excess of $510 million. Together this funding will permit a fill rate of 59,000 barrels per day, assuming an oil price of $19.09 per barrel.

In addition, we are requesting $196 million in our facilities budget, which is roughly the same as last year. Included in this is roughly a $10 million increase to continue capacity development, to ensure environmental compliance and site security, and begin repair or replacement of an on-shore section of the West Hackberry brine disposal pipeline.

NAVAL PETROLEUM RESERVE

The final element of the budget is the Naval Petroleum Reserve. Our budget request for the Naval Petroleum and Oil Shale Reserves is slightly greater than last year, $210 million compared to $189 million. This is mainly because we plan more development wells at Elk Hills. We have additional requirements due to higher water production, and we are installing a fourth steam generator, and conducting an EOR project at Teapot Dome.

We are projecting revenues to the Government in fiscal year 1991 of about $620 million. As you're aware, Mr. Chairman, accompanying our budget request for the Naval Petroleum Reserves is a proposal to lease Elk Hills and the Teapot Dome fields on a competitive basis. Our proposal includes a requirement for a lease bonus of $1.6 billion in addition to royalty payments. It also includes the creation of a Defense Petroleum Inventory within our Strategic Petroleum Reserve complex.

Thank you, Mr. Chairman. I'd be happy to answer any questions.

SPR ALTERNATIVE FINANCING

Mr. ATKINS. Thank you very much. The Secretary of Energy's letter to the Congress transmitting the study that you recently did on alternative methods of financing the Strategic Petroleum Reserve seeks authority to lease oil from one or more producing countries. Could you explain that proposal for us and why you considered that an attractive alternative?

Mr. GENTILE. Mr. Chairman, the intent here was to find ways of filling the SPR at less cost. We feel that the leasing option is an attractive option because what it does is allow us to have control over the oil but only pay for the carrying charge of the oil. At the end of the lease, depending on the type of lease that would be negotiated, that oil could be returned to the owner or we could use it. That would depend on how we negotiate the terms of the lease.

Mr. ATKINS. You were directed by the Senate to come up with alternatives to fill the Reserve at less cost. Was this the alternative that you found that was viable?

Mr. GENTILE. It's the only one that we found that was viable. We looked at several different options. We looked at oil bonds and the rate of return linked to oil prices. We looked at the Naval Petroleum Reserve and we looked at fees and charges on oil imports. We looked at mandatory storage requiring the private sector to store and we looked at facilities leasing.

EXCESS PRODUCTION CAPACITY

Mr. ATKINS. Tell me, you suggest in the letter that only oil leasing, or the Secretary suggests that only oil leasing from an oil-producing country with excess production capacity appears to offer the possibility for reducing the costs of SPR oil acquisition. Could you tell me for the record which countries have excess production capacity?

Mr. GENTILE. We're basically looking at the OPEC countries. That would be Kuwait, Saudi Arabia, Qatar, the United Arab Emirates, Venezuela, and Iraq, I think those are the countries.

Mr. ATKINS. So it would just be those countries?

Mr. GENTILE. Those are the countries that have excess capacity.

Mr. ATKINS. How about Norway?

Mr. GENTILE. Norway also has excess capacity, yes.

Mr. ATKINS. Are there any others?

Mr. GENTILE. Those are the ones that I'm aware of, Mr. Chairman.

FOREIGN INTEREST IN LEASING

Mr. ATKINS. Why would those countries be interested in reducing our oil acquisition costs?

Mr. GENTILE. Well, basically what it does is allow them to get around their OPEC quotas. In the process of getting around their quotas, it puts their oil here. It's not an assured sale, but it gives them revenue from the carrying charge of the oil. They're basically just taking oil out of their reservoirs—they have a very low lifting cost—and that's why they would be interested. We have talked with many of those countries as required by the study.

Mr. ATKINS. The $70 million figure would equate to less than 10,000 barrels a day for a year. Is that correct? If you're assuming that 100 million barrels are leased, and if you assume an annual figure of 70 cents a barrel for an annual lease——

Mr. GENTILE. Sixty to seventy cents.

Mr. ATKINS. Is that a reasonable——

Mr. GENTILE. Yes.

Mr. ATKINS. You'd even look at it at lower than that.

Mr. GENTILE. We're assuming that the carrying charge per barrel per year is about 60 to 70 cents.

Mr. ATKINS. So that would provide about $70 million to a participating country for leasing the oil to us?

Mr. GENTILE. I think it would be about $700,000 per year for 10 years, or $7 million, not $70 million.

Mr. ATKINS. 100 million barrels at 70 cents a barrel.

Mr. GENTILE. Is $70 million.

Mr. ATKINS. Is $70 million.

Mr. GENTILE. That's how my math works, too. Excuse me a minute. Yes, it is $70 million.

Mr. ATKINS. That gives you the $70 million figure. Assuming $20 a barrel, that equates to less than 10,000 barrels a day for a year. Is that correct?

Mr. GENTILE. I'm sorry. I'm not following that.

Mr. ATKINS. It would essentially give them the same revenue, equivalent revenue from the leases for an increase of production of 10,000 barrels a day for a year. Do you see what I'm saying? If you look at their revenues from the lease figuring 60 to 70 cents, and you look at that over the course of the year, that revenue would be roughly equivalent revenue to the sale of 10,000 barrels a day for a year.

Mr. GENTILE. That's right.

Mr. ATKINS. Now who'd be interested in such a marginal production gain under any circumstances?

Mr. GENTILE. Well, we've talked to many of the countries, and they're interested because they get around their quota. Right now they're held by the OPEC quota, and with this they could produce outside of the quota, since they would not be really selling the oil, they would be leasing us the oil and putting it into the SPR.

Mr. ATKINS. How many of those countries that you mentioned that had excess production are producing over the quota?

Mr. GENTILE. As Rick is mentioning to me, according to the press, there may be some that are, but we're not aware of them. We don't know what those figures are, but I will supply them for the record.

[The information follows:]

FOREIGN COUNTRIES PRODUCING OVER OPEC QUOTAS

In recent months, there have been reports in the press of a number of foreign countries exceeding their OPEC quotas. While many of these reports may be true, the number of countries exceeding their quotas at any particular time may vary from month to month. The Department recently has received reports of nine OPEC producers producing above their quotas.

PRODUCTION QUOTAS

Mr. ATKINS. But we have pretty good information on that. Virtually all of them are and, if they aren't, it's only for some temporary reason. They have in the past, and they plan to in the future, virtually all of the countries. I mean, the quotas haven't been particularly effective. There is no significant realistic penalty; there is no penalty that is sufficient to keep people from staying under that quota except voluntary restraint. Correct?

Mr. GENTILE. I think that is true, Mr. Chairman. I think the issue here is that when these discussions were held with the various countries they were interested in looking at this option because, regardless of what they are producing now, it gives them the ability to produce even more and still bypass the quota. This would not be charged against their quota. It would be their oil taken out of their in-ground reservoirs and put in our caverns.

Mr. ATKINS. I'm going to have to tell you that my credulity is stretched by the thought of the Saudis getting all enthused about getting $70 million over their quota. It seems to me that the real bottom line for these people, since there isn't any effective way of enforcing that quota, they can bounce over it, and the Saudis certainly have by far more than 10,000 barrels a day, is foreign policy concession.

Mr. GENTILE. Well, when we looked at the study, we talked to the countries in question about their interest. We did not talk about foreign policy concerns when we talked to them.

DISCUSSIONS WITH OTHER COUNTRIES

Mr. ATKINS. Would you have expected, even if they were looking for foreign policy concessions, that they would have discussed those with the Department of Energy? I presume that there is some level of subtlety there.

Mr. GENTILE. I'm not sure.

Mr. ATKINS. What countries have you discussed the concept with?

Mr. GENTILE. We've discussed it with the countries that I mentioned, and we discussed it with Norway. We had some discussions with Venezuela, with Saudi Arabia, the Emirates, Kuwait, Qatar, basically the countries that I mentioned. We also discussed it with some of our other partners, Japan and Nigeria. We discussed it with a fair number of countries.

Mr. ATKINS. Could you give me a sense of their response?

Mr. GENTILE. Well, we met with the United Arab Emirates, Kuwait, and Saudi Arabia on a joint DOE and State Department visit. They were very interested. We also met with the Mexican officials later, both here and in Mexico. They were not very interested. Norway is very interested. We did meet with them. We had less extensive contacts with the other countries I mentioned, Japan, Venezuela, Nigeria, Belgium, but the Saudis, Norway, the United Arab Emirates, and smaller Arab states were all very interested in the proposal.

Mr. ATKINS. And what kinds of things did they say to you other than expressing a general interest?

Mr. GENTILE. They were basically exploratory technical discussions, and that was where it went. We were to explore the opportunity, and that's what we did.

Mr. ATKINS. Now a number of those countries that you've mentioned have been involved in manipulating oil supplies and prices through OPEC. Is that correct?

Mr. GENTILE. We think so, yes, sir.

Mr. ATKINS. Why should we be dealing with those countries on this basis given their past histories?

Mr. GENTILE. We think that that may have been the case in the past, but what we're facing right now is the fact that they have interest in having this oil in the U.S. It gives them some downstream revenue. It also offers them constraints. They would not be interested in cutting off supply to us if they've got their oil sitting here in our caverns. So we think they are interested in some downstream opportunities.

Mr. ATKINS. But those are pretty miniscule compared to their overall revenues—what percent of their overall oil revenues would this amount to?

Mr. GENTILE. It would not be very significant.

Mr. ATKINS. Would it amount to 1/10 of 1 percent?

Mr. GENTILE. I'm not sure what their overall production is or what that would be. I'd be happy to supply that for the record, but I don't know that.

Mr. ATKINS. I'd appreciate that. Is it reasonable to assume that it would less than 1/10 of 1 percent?

Mr. GENTILE. Rick, do you know? We'd have to provide that for the record.

Mr. ATKINS. In my definition, that comes under the category of tiny, not small.

Mr. GENTILE. We'd have to supply that for the record. I don't know the answer to that.

[The information follows:]

PERCENTAGES OF OPEC COUNTRIES' INCOMES PRODUCED BY AN SPR LEASE

The percentages would depend upon a number of factors in addition to the production levels of each country. The critical factors would be the lease rate, the world price of oil, and the size of the lease. To illustrate the changes, the Department used average daily oil production for the first 11 months of 1989, and calculated annual incomes for four OPEC countries with which discussions have been held on the issue of leasing. It was also assumed that the Department would lease 100 million barrels of oil at annual lease payments of $0.50, $0.75, and $1.00 per barrel. The lease payments as a percentage of oil income are shown in the following tables. In no case does the lease payment reach one percent of annual oil revenue for any of the four countries.

PERCENTAGE OF INCOME FROM A 100 MILLION BARREL LEASE TO THE SPR

SAUDI ARABIA

	COST PER BARREL OF LEASE OIL PER YEAR		
WORLD OIL PRICE	$0.50	$0.75	$1.00
$16.00	0.17%	0.25%	0.34%
$18.00	0.15%	0.22%	0.30%
$20.00	0.13%	0.20%	0.27%

KUWAIT

	COST PER BARREL OF LEASE OIL PER YEAR		
WORLD OIL PRICE	$0.50	$0.75	$1.00
$16.00	0.48%	0.72%	0.96%
$18.00	0.43%	0.64%	0.86%
$20.00	0.39%	0.58%	0.77%

UNITED ARAB EMIRATES

	COST PER BARREL OF LEASE OIL PER YEAR		
WORLD OIL PRICE	$0.50	$0.75	$1.00
$16.00	0.45%	0.67%	0.89%
$18.00	0.40%	0.60%	0.79%
$20.00	0.36%	0.54%	0.71%

VENEZUELA

WORLD OIL PRICE	COST PER BARREL OF LEASE OIL PER YEAR		
	$0.50	$0.75	$1.00
$16.00	0.46%	0.68%	0.91%
$18.00	0.41%	0.61%	0.81%
$20.00	0.37%	0.55%	0.73%

SPR LEASE PROVISIONS

Mr. **Atkins**. Under what kinds of contract or lease provisions would the oil actually cost less if it was leased rather than purchased?

Mr. **Gentile**. The provisions of the contract would really dictate how it would be evaluated in terms of cost. What we're looking at is contracts that would give the President control of the oil and minimize the cost. Now how you would negotiate that contract in terms of what happens to the oil at the end of the term would significantly impact that cost. What we're seeking is the authority to go out and look at these opportunities and see what we can find in terms of exactly that.

Mr. **Atkins**. Do you assume that Congress would give you freedom to contract for that kind of oil without some sort of oversight or pre-approval process?

Mr. **Gentile**. Well, we think that, first of all, there is ability in the budget, as we move into the next year, to look at that opportunity. Further, we have had the freedom to purchase oil historically in the past. We think that the Department of Energy and the Strategic Petroleum Reserve has done a very good job of purchasing oil. Congress has confidence in that, and we think that that should continue.

Mr. **Atkins**. These are international agreements you'd be talking about.

Mr. **Gentile**. We have some international agreements right now in terms of purchasing oil.

Mr. **Atkins**. That's straight purchase though.

Mr. **Gentile**. It's straight purchase, yes. We purchase on the spot market, and we also do the straight purchase like in——

Mr. **Atkins**. This is something quite different.

Mr. **Gentile**. This is a leasing arrangement.

Mr. **Atkins**. Wouldn't these leases, and wouldn't our dependence on that leased oil, give the foreign country substantial leverage over the U.S.? And at a time when the U.S. would be particularly vulnerable?

Mr. **Gentile**. We don't see where there's any leverage, since the term of the lease would be that the oil is under the control of the United States. That's the number one, bottom line term of the lease. It has to be under the control of the U.S. The lease is not acceptable unless it is completely under our control.

Mr. **Atkins**. What are the other bottom line elements of the lease?

Mr. **Gentile**. That is the bottom line. The bottom line is that the oil is leased to us, we pay a carrying charge, and that it is under our control in terms of usage. The other terms of the lease would depend on how we negotiated it. It has got to be cost effective. If it's not cost effective, it serves us no purpose to lease. If we can lease, in today's dollars, more effectively than we can purchase, then it becomes an interesting opportunity.

Mr. **Atkins**. And would you like to be able to do that with no Congressional review of the lease?

Mr. **Gentile**. We think that the history of the Department in purchasing oil for the SPR has been good. We think that we have laid this out well in the study. We looked at the options, and we think leasing is an interesting opportunity. Yes, we would like to think that we should have that responsibility.

CONGRESSIONAL OVERSIGHT OF LEASE ARRANGEMENTS

Mr. ATKINS. So you think you should be able to do that and enter into any kind of lease that you want to with no Congressional oversight?

Mr. GENTILE. The entire intent here is to enter into a lease only if it becomes attractive in terms of cost. We would not let a lease if it were not a more effective way of dealing with filling the SPR. We also have the opportunity in the budget review next year to review exactly what we're doing in terms of leasing and/or purchasing.

Mr. ATKINS. But if your countries got this kind of lease and, in return, has some kind of either direct concession or implied foreign policy concession, that may be an enormous cost even though the dollar cost in the budget for SPR may be fairly minimal. The cost to the U.S. as a Nation may be quite significant.

Mr. GENTILE. Our intent is to look at leasing that is cost effective as compared to purchase. We have two options in front of us—purchasing oil at one price or leasing oil in such a way that the carrying charges, in today's dollars, are less than the purchase. That becomes a more attractive deal for us. There is still a matter of control of the oil. It is oil in our SPR that we control.

Mr. ATKINS. You're quite correct—your history in terms of purchase of oil has been good over the past. We're talking about something that is quite different, and we're not talking about some oil company coming in, and a corporate decision where there is just a bottom line, which is a dollars and cents bottom line. We're talking about the United States of America, where some business arrangement that you may enter into for leasing oil has significant foreign policy implications.

Frankly, I'm quite surprised by your reluctance to provide for Congressional review, oversight, and pre-approval of that kind of agreement, particularly given the very broad latitude that you're looking for.

Mr. GENTILE. Well, again, our analysis of the leasing option is based strictly on dollars. It was not based on foreign policy considerations or concessions. We think that we have to look at it on the basis of what is the best buy for the SPR. Strictly on those terms.

We also think that if we get into a lengthy process of negotiating, and then a lengthy process of review, then the deals could fall apart and become much more costly.

Mr. ATKINS. Why would they fall apart if they——

Mr. GENTILE. Well, we think that once we get into the negotiating phase, if our bottom line is "control the oil and costs for the SPR," if we get into a lengthy review process, we're not going to be able to control those costs, and the profits aren't going to be firm.

Mr. ATKINS. What if those sales have foreign policy implications? If there are implied concessions and vulnerability that exists for the U.S. in terms of our foreign policy?

Mr. GENTILE. We don't see that as the approach at all. We're saying in terms of——

Mr. ATKINS. I understand. Suppose that that is the effect. I mean, things do oftentimes, in this business, have unintended consequences.

Mr. GENTILE. I think that it would be up to the Department to review that.

Mr. ATKINS. So it's none of Congress' business?

Mr. GENTILE. I think Congress has an oversight role especially, and also an interest in terms of doing the budget. That would be our——

Mr. ATKINS. So we couldn't review it until it came up in a subsequent-year budget?

Mr. GENTILE. That's the intent of the existing structure, yes. Not to exclude Congress, but just to deal with it in the normal process. We'd also have to have full interagency review.

Mr. ATKINS. So you would find the lease arrangement unacceptable if there were any kind of Congressional pre-approval involved?

Mr. GENTILE. I didn't say that, Mr. Chairman. I said that we present our proposal in such a way to facilitate an easy lease if the price were right, and if it made sense for the SPR. We did not preclude Congressional interest in the leasing arrangement. We just think the best idea is to go the way we have suggested.

Mr. ATKINS. You had a hearing on this subject before the authorizing committee in the Senate?

Mr. GENTILE. Yes.

Mr. ATKINS. And what was their feeling on it?

Mr. GENTILE. Regarding the leasing, they were in favor of the leasing concept. They seemed to be quite favorable toward it.

Mr. ATKINS. With no Congressional approval?

Mr. GENTILE. I don't think we got into that at all. I don't recall getting into that.

Mr. ATKINS. If the Government reconsidered a lease once it was in place and had to purchase alternative oil, wouldn't it likely cost more than if we purchased it originally?

Mr. GENTILE. Well, it would given trends. All right? I think you're asking me, "Ten years from now, is the price of oil going to be more expensive than it is today?" Yes, it might be. More than likely it would be. The fact is that at the end of 10 years, we would then have the option, depending on how we negotiate the lease, to turn the oil back to the lessor. If we decided that we didn't need that oil at that point in time, we would have paid the rent on the oil and turned it back to the lessor.

STORAGE OF LEASED OIL

Mr. ATKINS. Would leased oil be stored in existing SPR facilities?

Mr. GENTILE. Yes, sir. It would be.

Mr. ATKINS. Would it be segregated?

Mr. GENTILE. No, there would be no need to segregate it. We would be buying and testing it as we buy and test a product. It would be segregated in terms of the specification of the oil as we normally segregate our caverns. It is oil of the same kind.

Mr. ATKINS. How would you determine whether you were using the oil that you bought or the oil that you leased?

Mr. GENTILE. It, like many bulk commodities, is a fungible. You make that determination based on the specification. Whether it's our oil or their oil, it is a matter of barrels under that specification.

Mr. ATKINS. You'd have to predetermine that for the foreign country though?

Mr. GENTILE. Yes. I mean, it would be predetermined as it comes in, and then it would be a ratio of whatever oil we have of the same spec in that cavern.

Mr. ATKINS. Do you expect to request authority for leasing for other-than-foreign country involvement?

Mr. GENTILE. Yes, we want general authority to lease. Wherever we can lease oil, the cheapest, that makes sense, wherever the oil is cheap enough so that we can lease it, rather than purchasing it, that's where we'd like to have the authority.

Mr. ATKINS. Do you expect to request authority to lease facilities as well as oil?

Mr. GENTILE. No, we do not. We feel that we have sufficient facilities to do that. We're buying oil for the SPR to store up to 750 million barrels. We have the facilities in place, and are currently leaching, to allow us to have the caverns that would be able to store that oil.

OTHER FINANCING METHODS STUDIED

Mr. ATKINS. Can you tell me what other financing methods you studied and why they were considered unsatisfactory?

Mr. GENTILE. Yes. We looked at several options. We looked at oil bonds, and we thought that because of Treasury rates they would not be very attractive. We looked at the Naval Petroleum Reserves, but we see that as operating already outside of that, and being able to take good revenue and add to the SPR, and it would not reduce the deficit if we did that with the Naval Petroleum Reserves.

We also looked at mandatory private storage. Quite honestly, that was a rather onerous option in that we thought it would result in higher costs all the way across the board to both the consumers and also in terms of salt dome storage.

The other thing we looked at was fees and charges. As you know, Mr. Chairman, the Administration is opposed to, for tax and trade policy reasons, any tax on imported oil.

FUTURE SPR FILL RATES

Mr. ATKINS. What rates do you assume that the Reserve will be filled in the future?

Mr. GENTILE. In the budget request for 1991, we are looking at 59,000 barrels a day.

Mr. ATKINS. Fifty?

Mr. GENTILE. 59,000.

Mr. ATKINS. So under that assumption, when will the 750 million barrel capacity be reached?

Mr. GENTILE. FY 1999.

Mr. ATKINS. FY 1999?

Mr. **Gentile**. At that fill rate of 59,000.

DISTRIBUTION ENHANCEMENTS

Mr. **Atkins**. And what is the earliest that their required distribution enhancements to utilize that capacity can be in place?

Mr. **Gentile**. 1992. We currently have a distribution capacity of about 3.5 million a day. That is going up to 4 million at the end of 1991. That is the trend that we're on right now.

Mr. **Atkins**. Okay. And that will increase from what sites?

Mr. **Gentile**. Big Hill and Bryan Mound.

SULPHUR MINES SOLICITATION

Mr. **Atkins**. In your February 16, 1990, Annual Report, you state that a solicitation to sell the Sulphur Mine site will be issued in the first quarter of 1990. Was it?

Mr. **Gentile**. It is scheduled for May.

Mr. **Atkins**. You were scheduled for the first quarter, and it is now May?

Mr. **Gentile**. It is now going to be April or May; May 16, I think.

Mr. **Atkins**. Why was that delayed?

Mr. **Gentile**. Just the process—we were delayed a month.

Mr. **Atkins**. Can you tell me what kind of interest there is in the site?

Mr. **Gentile**. Well, we have had seven corporations formally respond to the solicitation, and there have been numerous phone calls.

Mr. **Atkins**. Can you tell us the corporations, for the record, that have responded?

Mr. **Gentile**. I don't think we should do that. We can't do that, I don't believe. It think it——

Mr. **Atkins**. I'm a little confused.

Mr. **Gentile**. It was a solicitation of interest.

Mr. **Atkins**. So it's not the formal RFP?

Mr. **Gentile**. No.

Mr. **Atkins**. If the site is sold, what would be the disposition of the funds?

Mr. **Gentile**. Well, if the site were sold, if it were cash, it would go to the Treasury. If it were sold for in-kind oil, that oil would go into the SPR.

Mr. **Atkins**. So if you do sell it for cash, do you need special authority to retain the funds to purchase oil?

Mr. **Gentile**. Yes. If it were sold for cash, that cash would automatically go to the Treasury. We would not have the authority to use that money.

Mr. **Atkins**. Do you expect to seek the authority to use the money?

Mr. **Gentile**. Not at this time. We would be looking for the oil—we would exchange the oil that would be sold and it would go into the SPR. Then the question is the cash for the facility. Again, if we could negotiate a deal that we would get paid in kind, in oil, that would go into the SPR. If we got the receipt in cash, it would, however, go into the Treasury.

Mr. **Atkins**. So how will you make a determination whether to be paid in oil or in cash?

Mr. **Gentile**. It depends on the deal. It depends on the best deal and the economics of the deal.

Mr. **Atkins**. But, obviously, from your point of view, the best deal is one that is oil and not cash.

Mr. **Gentile**. Not necessarily. It is whatever is best for the country in terms of the cost. If we get it in oil, it goes into the SPR. If it doesn't, it goes into the Treasury, and then we'd have to look at whether we would want to request that money for additional oil. It really doesn't affect the oil budget or the facility budget.

Mr. **Atkins**. It seems to me we ought to make a decision whether it appropriately ought to go to the Treasury or back into the SPR. If it's going to go to the Treasury, it ought to go to the Treasury irrespective of whether you're paid in cash or in kind. If it ought to go into the SPR, it ought to go irrespective. There shouldn't be this arbitrary thing.

Mr. **Gentile**. It is a matter of authority. I think, according to the authority and the law, we have the authority to exchange oil.

Mr. **Atkins**. I understand that, but you don't have the authority to keep the cash. I appreciate that. That's what I said. My question to you is why you aren't seeking that authority?

Mr. **Gentile**. We're not seeking it at this time; we may seek it in the future. I'm not even sure that we've looked at that in terms of an option at this point.

Mr. **Atkins**. Well, your time is limited in terms of the budget. We're under some pressure for this Committee because if it goes to the Treasury that's not available money. We're not getting additional money for the SPR because you didn't seek the authority. It seems to me you've got to make a decision pretty soon if you want to have impact on our appropriations process.

Mr. **Gentile**. Let me try to explain in a different way. We come in with a request for a facilities budget. That facilities budget requests what we need in terms of facility development and maintenance. The oil is a different line item. We would say that for the facility money, if we could get it in oil, we'd take it in oil. Otherwise, it goes into the Treasury. We'd come back to you if we needed more facility money.

Mr. **Atkins**. Yes. The problem is that the Treasury doesn't give us the money when you come back for more oil money. The Treasury keeps the money, and you come back and ask for money from us from a limited pot of money. As far as we're concerned, the money between your facilities and your oil acquisition is unfungible, just as your oil is fungible. Money that the Treasury has is not money that this Committee can appropriate.

Mr. **Gentile**. Again, we would have to come back, via appropriations, through our own internal process. That's the only way that we see that we could do that at this point.

Mr. **Atkins**. OMB, I would suspect, is not going to let you request the authority which seems to me is going to skew the decision. I would hope that you would give us some guidance, so that we can make that decision.

Mr. **Gentile**. We would be happy to work with the Committee. What we're looking at right now is, again, trying to negotiate the best deal we can. If we can get it in oil, we'd like to have it in oil.

Mr. **Atkins**. But your decision, when you make it, assuming that your proposal that is in oil, is 1 percent more expensive than the proposal that's in cash——

Mr. **Gentile**. No, it'll be the bottom line dollar, the value of the oil in kind or the dollar. We will make the decision based on the best deal in terms of total dollars.

Mr. **Atkins**. So it doesn't matter what your preference is then?

Mr. **Gentile**. We would like to have it, but the decision would be made on bottom dollar.

Mr. **Atkins**. What you'd like if you're going to do what you dislike—it's like broccoli, if you're going to eat it anyway, it doesn't matter whether you like it or not. [Laughter.]

Mr. **Gentile**. Yes. I agree with that if we have the option of accepting either in oil or in cash. If it's the same bottom dollar, we'll take the oil.

REMOVAL OF OIL FROM SULPHUR MINES

Mr. **Atkins**. When do you intend to remove the oil from the site?

Mr. **Gentile**. We would remove the oil, depending on the deal that was worked out, whenever—if we sold it, we would move it. If DOE does not sell the site with an oil exchange provision, we'll start transferring the oil at the end of this year and complete it in the end of the next calendar year. The maintenance charges are getting too high to carry it, and so if we don't sell it soon, we'll remove the oil.

Mr. **Atkins**. What are your maintenance charges?

Mr. **Gentile**. We'd have to provide that for the record, but compared to our other site, it is drastically more expensive to operate this site. That's why we want to close it down and sell it.

Mr. **Atkins**. If you could provide that for the record——

Mr. **Gentile**. We would be happy to.

[The information follows:]

Cost to Maintain the Sulphur Mines Sites

The cost for standby operations, maintenance, security and environmental activities at the Sulphur Mines site is approximately $4 million per year.

REPAIR OF WEST HACKBERRY LINE

Mr. **Atkins**. The budget indicates that repairs on the West Hackberry brine disposal line are required. Can you indicate for us what the annual cost would be on that and when it will be completed?

Mr. **Gentile**. For repairing the on-shore portion of the West Hackberry, the cost plan is in fiscal year 1990, $0.5 million; in 1991, $3.7 million; in 1992, $7.1 million, for a total of $11.3 million. It takes about 18 to 20 months to get that done.

SPR SECURITY

Mr. **Atkins**. At the end of 1988, DOE received authority to have your protective force personnel carry firearms. Have those provisions been implemented?

Mr. **Gentile**. We have done that. They have been armed under applicable State laws since 1979. Congress granted arrest authority in October 1988. The guidelines are currently under review by the Department of Justice, and the guidelines will be published in the Federal Register around June with implementation in late 1990.

Mr. **Atkins**. Have you made all of the capital improvements that you need to make to enhance security?

Mr. **Gentile**. The improvements made to date have basically been fencing in and hardening of the critical areas. We have done some work at the entrances with barriers. We have guard booth upgrades and key and lock systems. In 1990, we are planning some additional perimeter detection and some barriers. Throughout the next four to five years, we are doing a perimeter assessment and detection at the various sites.

ROLE OF FOSSIL ENERGY FOR SPR

Mr. **Atkins**. Can you explain for me the role of Fossil Energy in the Strategic Petroleum Reserve program versus that of the Emergency Preparedness organization and also the Oak Ridge Operations Office?

Mr. **Gentile**. The role of Fossil Energy is one of policy development oversight. Oak Ridge does the daily management and implementation of that policy. Meanwhile, the Office of Emergency Preparedness or Energy Emergencies develops the emergency policy. Should we get into an energy emergency, it is they who will take over the SPR during that emergency supply function.

ENHANCED OIL RECOVERY PLAN FOR SPR

Mr. **Atkins**. On page 250 of your budget justification, there is a $2,725,000 increase included for something that you refer to as "an enhanced recovery plan." Can you explain what that is?

Mr. **Gentile**. The recovery plan is a way to respond. It is not enhanced oil recovery as we normally talk about it in terms of Fossil Energy. It is our ability to recover from damages, so it means keeping spare stock of parts, of major components, and our ability to respond quickly to repair damage once it is incurred.

Mr. **Atkins**. You don't presently have that capacity?

Mr. **Gentile**. Yes, we do. This was an enhancement to that.

Mr. **Atkins**. But the present capacity is inadequate?

Mr. **Gentile**. We went through some enhancements in the recovery plan. As the site gets larger and larger, we feel we need to do some work on it, and we did. We enhanced that recovery plan. That was the intent of this.

Mr. **Atkins**. Give me an example of——

Mr. **Gentile**. For example, we may feel that we need an additional set of backup pumps that we can keep off-site in case a series of pumps go down. We may have needed an extra pump, given the number of pumps we were using, to be able to replace it with.

Mr. **Atkins**. Do you project those needs based on a vulnerability analysis?

Mr. **Gentile**. They're projected on a couple of things—a vulnerability analysis and also the size of the SPR as it continues to grow.

Mr. ATKINS. And who does that work?

Mr. GENTILE. It's done in conjunction with Oak Ridge and the security people in the Department.

Mr. ATKINS. Have you reviewed the assumptions that they use?

Mr. GENTILE. I have not personally reviewed that, no, sir.

Mr. ATKINS. But your office has?

Mr. GENTILE. Yes, my office has.

Mr. ATKINS. And they are in concurrence with the assumptions that you——

Mr. GENTILE. Yes, they are.

RENTAL PAYMENTS TO OTHERS

Mr. ATKINS. On page 259 of the budget justification, rental payments to others, you have an increase from $500,000 in 1990 to $1.1 million in 1991. Can you tell me why you have that increase?

Mr. GENTILE. Well, there is no actual increase. The obligations in FY 1990 of $506,000 assume the use of prior year uncosted balances of $635,000. So the total cost in that year was $1,141,000, so we don't really have an increase. The obligations in FY 1991 are $1.155 million, so there is not much of an increase. We had some carry over that we were using.

INCREASE IN SPR STAFF

Mr. ATKINS. What is the justification for an increase of eight personnel in Reserve staffing?

Mr. GENTILE. Well, the eight FTEs are requested because we feel we need a few more FTEs in terms of oversight, especially in the area of environment and health. They are all field FTEs.

NAVAL PETROLEUM AND OIL SHALE RESERVES

Mr. ATKINS. Let's move on, if we can, to the Naval Petroleum and Oil Shale Reserves. If there are any additional people you want to bring up front——

Mr. GENTILE. We're fine, I think.

Mr. ATKINS. Do you want to bring in any relievers?

Mr. GENTILE. They're sitting right behind me. The ones with the stripes back here. Captain Taylor may join us. We'll see if we need Captain Taylor or not.

Mr. ATKINS. Why don't you bring Captain Taylor to the table. Captain, if you could, just give your name and your title for the stenographer. That would be helpful.

Captain TAYLOR. I'm Captain Robert Taylor. I'm the Director of the Naval Petroleum and Oil Shale Reserves at the Department of Energy.

Mr. ATKINS. You don't look happy to be here. [Laughter.]

You looked like you were nice and comfortable back there.

LEASE OF NAVAL PETROLEUM RESERVES

Can you describe the features of your plan to lease the Naval Petroleum Reserves?

Mr. GENTILE. Basically, what we've done here is look at an upfront, one-time bonus payment of about $1.6 billion. That would be spread over three years, $1 billion in 1991, and $300 million in each of 1992 and 1993. That would be basically up front in terms of facilities. We would then be looking for about a 15 percent royalty rate on the revenue.

Mr. ATKINS. And how many years have you proposed this kind of——

Mr. GENTILE. This is the first time we have proposed the leasing. We proposed sale before.

Mr. ATKINS. And how many times have you proposed the sale?

Mr. GENTILE. Several.

Mr. ATKINS. What's happened to it?

Mr. GENTILE. It's not been very well received, Mr. Chairman.

Mr. ATKINS. What makes you think that the lease would be any——

Mr. GENTILE. The leasing opportunity has a little different twist to it. There was concern with the independent refiners that the sale would curtail their business. We don't see that in this scenario. We see that we still have their options to get the oil from the Elk Hills. We think that there is a large enough up-front cash payment. Royalties would reflect the prices as they increase. There would be increases in Federal income tax, State income tax, and State service taxes. That's basically the approach.

Mr. ATKINS. Do you expect to submit legislation to Congress?

Mr. GENTILE. Yes, we do.

Mr. ATKINS. When do you expect——

Mr. GENTILE. Next month.

Mr. ATKINS. Has the authorizing Committee shown any interest in the legislation?

Mr. GENTILE. We have some interest on the House side.

Mr. ATKINS. Before you were batting, in the last five years, zero in your sale. Did you con someone this time?

Mr. GENTILE. Yes, we did. What did we pay them? [Laughter.]

Mr. ATKINS. Was it a live one? [Laughter.]

DEFENSE PETROLEUM INVENTORY

Can you tell me why the Defense Petroleum Inventory of 10 million barrels only appears in the divestiture proposals?

Mr. GENTILE. Well, because if we divest of Elk Hills, DOD would like to have that set aside. If we don't, they have access to Elk Hills in case of an emergency.

Mr. ATKINS. But they have access to SPR in an emergency?

Mr. GENTILE. No, not directly. In SPR, those sales are competitive. We're selling that SPR oil that we put out on the market. It is not a Defense reserve.

Mr. ATKINS. If the Defense Production Act were involved, they could have access to it?

Mr. GENTILE. That is product; it's not crude. It doesn't apply to crude oil. Our SPR is all crude oil.

Mr. ATKINS. They could take over other facilities as well.

Mr. GENTILE. I, personally, don't know how that works.

Mr. ATKINS. They want the product. They're not looking for crude oil.

Mr. GENTILE. That's right.

Mr. ATKINS. So they could take the product out of——

Mr. GENTILE. We don't have any product in the SPR. We have crude. The idea here is we have crude at Elk Hills.

Mr. ATKINS. This would be crude, too, though.

Mr. GENTILE. Yes, it would be crude. There is a refining center there, and it would give them that opportunity to tap that oil should they decide to send it to the refineries.

Mr. ATKINS. Now the budget impact on this would be to increase your revenues by $1 billion.

Mr. GENTILE. $1.6 billion and a bonus.

Mr. ATKINS. $1.6 billion and a bonus. And then, of course, you'd lose revenues in subsequent years.

NPR LEASE PROPOSAL

Mr. GENTILE. We would be getting $1.6 billion and a bonus and then we would get about 15 percent in royalty, probably in-kind royalty, on the production off the reservoirs.

Mr. ATKINS. And then the other 85 percent goes to the private sector.

Mr. GENTILE. Correct.

Mr. ATKINS. So where is your crossover point where the Government starts losing money compared to our present revenues and our present revenue projections?

Mr. GENTILE. Actually, it is a break even. We projected a break even.

Mr. ATKINS. But that won't happen because the private companies aren't going to lease it unless they're going to make money.

Mr. GENTILE. No, I'm sorry, from our perspective, it is a break even. What we looked at is a whole series of taxes. What is in the basket of revenue coming into the Government? Right now, Elk Hills, being a Federal facility, doesn't pay taxes. If we leased it, we would get the $1.6 million up front in bonus payment, and 15 percent royalty. Meanwhile, the operator, or the lessor, would then have to pay State income tax, Federal income tax, property taxes, and severance taxes. That's how we created the deal.

Mr. ATKINS. If he has to pay all those taxes, it is still going to be built into the price and the cost that you can get.

Mr. GENTILE. It would be built into their operating costs. If they're getting their product out, they have to operate the field, and they're going to put that charge on the price of oil. We share in that to the tune of 15 percent.

Mr. ATKINS. Did you favor this proposal?

Mr. GENTILE. Yes, sir.

Mr. ATKINS. Did you generate the proposal?

Mr. GENTILE. No, I did not.

Mr. ATKINS. Where was it generated? Office of Management and Budget?

Mr. GENTILE. I'm not sure.

Mr. ATKINS. Does that mean it was deus ex machina. Did it appear to you in a vision? [Laughter.]

Mr. GENTILE. It appeared in our budget——

Mr. ATKINS. Well, we were referring to a similar revelation that occurred in the Appropriations Committee recently. [Laughter.]

So where did the proposal come from?

Mr. **Gentile**. It came in a budget passback.

Mr. **Atkins**. Budget passback?

Mr. **Gentile**. We got it back from OMB.

Mr. **Atkins**. From OMB? Were you surprised to get the budget——

Mr. **Gentile**. No, I don't think we were. The Administration, for many years, has been promoting the sale of the NPR. This was seen as one way of accomplishing the objective of getting the Government out of the oil business and getting us out of competing with oil companies for a package you can deal with that may be acceptable. That gave us the leasing idea.

Mr. **Atkins**. Do you think now, based on what you know, that the deal is acceptable?

Mr. **Gentile**. I think the deal is more acceptable to many of the parties who object——

SUPPORT FOR NPR DIVESTITURE OR LEASING

Mr. **Atkins**. Did you have any support at all previously?

Mr. **Gentile**. We did not have a bill introduced, so the support would have been minimal.

Mr. **Atkins**. Didn't you not have a bill introduced because you couldn't find anybody who wanted to introduce it?

Mr. **Gentile**. Yes.

Mr. **Atkins**. There are 435 Members of the House and 100 Members of the Senate. You couldn't get a single member to introduce the legislation?

Mr. **Gentile**. That's right.

Mr. **Atkins**. And you came up with a proposal how many years in a row?

Mr. **Gentile**. Four.

Mr. **Atkins**. And you think this one is more popular?

Mr. **Gentile**. We think it is more popular for several reasons.

Mr. **Atkins**. But it doesn't take a lot for it to be more popular. [Laughter.]

Mr. **Gentile**. There are several reasons why it may be more popular. One, it was very unpopular with the independent refiners in the local area because they would be precluded from the source of product. We don't see that happening in this proposal. They will still be able to use the product.

Mr. **Atkins**. But you don't think this is going to happen in time for this——

Mr. **Gentile**. I'm not sure. We will be moving forward with this hopefully next month.

PRODUCTION ESTIMATES

Mr. **Atkins**. The budget shows production estimates of 96,800 barrels of oil per day for fiscal year 1989. Are you producing at those levels in FY 1990?

Mr. **Gentile**. No. We're producing at about 85,000 barrels.

Mr. **Atkins**. Why is that?

Mr. **Gentile**. That's partly because some of the enhancements have been deferred and, also, partly because the budget projections, in terms of production numbers, are projected a couple of years out. They were projected two years ago. We're at approximately 85,000 now. It is a declining field, but we have adjusted our projections to that.

DEFERRAL OF ENHANCEMENTS

Mr. ATKINS. Why have the enhancements been deferred?

Mr. GENTILE. They were projects, different types of projects for different reasons. Some were technical and some we had to prioritize between different doing projects and doing some testing.

Mr. ATKINS. Could you provide that for the record?

Mr. GENTILE. Yes, we'd be happy to.

[The information follows:]

DEFERRAL OF FACILITY ENHANCEMENTS

Three large capital intensive projects constituted the majority of the FY 1991 Program Planning Level, requested by the Office of Naval Petroleum and Oil Shale Reserves. The Department made the decision to attempt to fund these capital projects outside the Federal budget process through private sector financing. The three projects and their estimated costs were:

[In million of dollars]

Project:	*Cost*
Gas operations expansion project	81.6
Butane isomerization facility	10.9
NOSR gas protection program	10.7

NEW PRODUCTION FACILITIES

Mr. ATKINS. On page 198 of your budget justification, it refers to the need for new production facilities, including a gas processing plant and an isomerization plant. When will those facilities be needed?

Mr. GENTILE. Well, they could be used now in terms of the production capacity. We have not requested them, but those things, in terms of capacity, could be used now. We just have budget priorities and reasons to do other things.

Mr. ATKINS. What would be the quantitative effect on production? When would that effect begin if those facilities were not built?

Mr. GENTILE. Well, the isomerization doesn't have an effect on production since it really represents an opportunity we could add on top of our production. It is not really a production——

Mr. ATKINS. It would still have an effect on the actual production versus your potential production.

Mr. GENTILE. No. It is taking a product and processing a product, which is a different type.

Mr. ATKINS. So it would have an effect on your revenue?

Mr. GENTILE. Yes. It would have an effect on revenue.

Mr. ATKINS. What would the effect on revenues be?

Mr. GENTILE. They sell for about twice the regular product, so it would be a considerable difference in the product price that we receive.

Mr. ATKINS. The gas processing plant—what effect would that have on production?

Mr. **Gentile**. Well, the gas processing plant would have an effect in terms of being able to draw down more oil. It's about 4,000 barrels of oil and about 251,000 gallons of natural gas liquids a day.

Mr. **Atkins**. When would that start?

Mr. **Gentile**. That would not start. We're not funding that because, as I mentioned, we have some other priorities.

Mr. **Atkins**. So we're losing that money?

Mr. **Gentile**. We're deferring that money.

Mr. **Atkins**. Are we losing ultimate recovery on it?

Mr. **Gentile**. No.

Mr. **Atkins**. There is no effect in ultimate recovery?

Mr. **Gentile**. We don't think there is, no.

Mr. **Atkins**. Can you provide precisely your view as to ultimate recovery for the record?

Mr. **Gentile**. We'd be happy to.

Mr. **Atkins**. And the cost of the facilities?

Mr. **Gentile**. The cost of building the facilities? Yes.

[The information follows:]

Ultimate Recovery

Implementation of the gas plant has no bearing on the ultimate recovery of hydrocarbons from any of the NPRC reservoirs, since the production of that additional oil and liquid natural gas is not rate sensitive. Deferral of the gas operations expansion project does, however, constrain field-wide gas handling capabilities and implementation of associated production strategies. Paramount among those strategies is the cycling of gas through the 26R reservoir so that additional natural gas liquids can be processed and sold. Additional gas capacity will also allow the field to produce a number of wells shut-in because of the high volumes of gas produced with oil. It is estimated that if capacity exists to process that gas, an additional 4000 barrels of oil per day could be produced from shut-in, high gas/oil ratio wells.

NPR PRODUCTION FACILITIES FUNDING REQUEST

Mr. **Atkins**. Have you requested any funds for the program, either to the Secretary or to OMB?

Mr. **Gentile**. Yes, we did request those funds to the Secretary in the Fossil Energy budget request.

Mr. **Atkins**. What was the request?

Mr. **Gentile**. It was approximately $82 million for the gas plant.

Mr. **Atkins**. Now the justification also states that it would be very difficult to fund these requirements through the appropriations process. Why do you suggest that?

Mr. **Gentile**. Well, because of the large budget deficit and the emphasis on the near-term types of activities, we just think that we had other priorities that we needed to fund, and this would not be what we needed. It was suggested in the language that that was the approach we take.

Mr. **Atkins**. So that wasn't that it would be difficult to fund the requirements through the appropriations process, but rather that you wouldn't choose to do that?

Mr. **Gentile**. We chose not to do it in terms of requesting it in the budget because of other priorities. That's the reason we chose not to do it.

Mr. **Atkins**. Your priorities. The way you have it written it sounds like your analysis of Congressional priorities, given your acute observations and Congressional behavior on sale of——

Mr. **Gentile**. And finding someone to sponsor the sale of the oil field.

Mr. **Atkins**. Can you tell us why you made those priorities, given the potential revenues that could come from the——

Mr. **Gentile**. Just strictly a matter of competing projects, limited funds, and the need to decide on those projects that had the most impact for us.

Mr. **Atkins**. But on those two facilities, the gas processing plant and the isomerization plant, how many years production will it take before the plants fully pay for themselves?

Mr. **Gentile**. In the gas plant, payback is about 1.3 years. In the isomerization, it is about nine months. It was just a matter of prioritizing between different projects.

Mr. **Atkins**. In my book—maybe I'm missing something—the payback is a pretty good deal.

Mr. **Gentile**. Some considered that.

Mr. **Atkins**. Would you invest in that?

Mr. **Gentile**. More than likely.

Mr. **Atkins**. If it was your own money?

Mr. **Gentile**. I think Congressman——

Mr. **Atkins**. Did you have something that was a faster payback than nine months?

Mr. **Gentile**. No. It was a project that we were looking at. Among the priorities, the Secretary had to make decisions. He felt that he had other priorities where we needed the money more. I think that is a perfectly valid approach on the part of the Secretary.

Mr. **Atkins**. What were the other priorities that bumped this?

Mr. **Gentile**. I really don't know. It would be Department-wide priorities.

Mr. **Atkins**. Has Congress ever reduced your previous request for production facilities for Elk Hills?

Mr. **Gentile**. No, they haven't.

EXPLORATORY PROGRAM AT ELK HILLS

Mr. **Atkins**. Could you tell us a little bit about your exploratory program for Elk Hills?

Mr. **Gentile**. Yes. The objective of the exploratory program is to look at some of the deeper formations. We've drilled the deepest test well in California, about 25,000 or 26,000 feet. We have drilled four deep wells and tested several zones. We've not found too much oil, but there is some potential for gas production.

Mr. **Atkins**. Commercial gas production?

Mr. **Gentile**. Yes.

Mr. **Atkins**. It appears that you are deleting the program in fiscal year 1991. Is that correct?

Mr. **Gentile**. No, we're not. We're completing the projects that we had on tap, and in fiscal year 1991 we have requested $500,000 to complete those projects. What we're really doing is evaluating seismic data that came out of the deep tests. That will not be completed until late 1991.

Mr. **Atkins**. We have a vote over on the House floor. I'm going to put the Committee into recess for 15 minutes.

[Brief recess taken.]

Mr. Dicks (acting chairman). The committee will come to order. The Chair recognizes Mr. Regula.

Mr. Regula. Thank you, Mr. Chairman.

I have a number of items on clean coal that I'd like to ask at this point. Mr. Chairman, I'd like unanimous consent to insert a number of questions into the record.

Mr. Dicks. So ordered.

GAO REPORT ON CLEAN COAL TECHNOLOGY

Mr. Regula. GAO has been conducting a survey of utilities for potential use of clean coal technology. The preliminary conclusions are that despite the potential of these new technologies they may not contribute significantly to the reduction of acid rain because of emissions during the next 15 years, in part because of when these technologies will be commercially available, and then the additional lead time necessary. What is your reaction to this? Do you have an estimate of commercial availability of technologies presently being developed?

Mr. Gentile. We have that, Congressman. We think that some of those deadlines are tight. We do feel that many of those projects are coming on line. In terms of the advanced physical cleaning, we look at about 1995 to 1998; for chemical and biological cleaning, 1996 to the year 2000; atmospheric circulating fluidized bed, from about 1996 to the year 2001; pressurized fluidized bed from about 1998 to 2003; slagging combustors and advanced slagging combustors, about 1993 to 1997; gas reburning 1995 to 1999; post-combustion injection, about 1991 to 1995; advanced scrubbers, 1995 to 1999; integrated gasification combined cycle, 1998 to 2003.

GAO REPORT

Mr. Regula. So the time to take the next step is somewhere in the late 1990s. The GAO report said it could take another five to ten years beyond the date of commercial availability for these technologies to be widely deployed, and then they go on to say that once utilities approve them and widely deploy them, they could play a major role in combatting acid rain. Would you agree with that statement?

Mr. Gentile. Yes, that is a fair representation. I think it is probably taking about five years from the time that they are commercially viable to when utilities make the decision to actually deploy them so those are probably the right numbers.

Mr. Regula. The GAO analysis concludes that utilities' interest in using clean coal technologies to meet SO_2 emission requirements seem to be linked more to the timeframes for compliance than the level of reductions to be met. Would you agree with that? In other words, I think that the GAO's report is saying that they can get the reductions once they get by the timelines that it takes to get these onstream.

Mr. Gentile. My reaction is that, while that might be the case, there are two different issues here. One is the reductions, and the other is the next generation of power-generating capacity that we need as we cross into the next century. We have a little bit of both at play here. Hopefully, the Clean Coal program, while it is attacking some of our more immediate problems, is also attacking those long-term problems, so that as we move into the next century we have those technologies available. They are drastically going to reduce emissions and really perform. There is a little bit of both going on here.

Mr. REGULA. According to GAO's survey, industry officials have also indicated two other issues that are affecting the demonstration of clean coal technologies—cost recovery and EPA emission requirements. The cost recovery issue centers on whether States will allow utilities that elect to participate in the development of clean coal technologies to recover the cost associated with demonstrating these technologies at their power-generating plants. Only a few States, including Ohio, have developed specific incentives to allow utilities to recover demonstration costs. Is this a problem? Is there anything the administration can do to develop the necessary financial incentives?

FINANCIAL INCENTIVE

Mr. GENTILE. This has been particularly problematic in some ways. In regard to the issue of what we refer to as "repayment," we're looking at spending taxpayer dollars. If the project becomes a successful project, should the taxpayer then be able to recoup their investment? That is basically the approach that we've been trying to take. There has to be some sort of involvement here in terms of recouping that investment.

In terms of the work of the PUCs, there are financial incentives in the Clean Air Act. We are encouraging States to really promote that type of activity. Ohio, of course, has been one State that has been very active in the entire range of activities, from funding projects to dealing with some of these issues. Other States have not been as good at that.

The issue of what we refer to as "the WEPCO issue," has some problems that we are concerned about, and we are working with EPA on that. The impact of "WEPCO" could mean that some projects are basically not going to continue or will not be proposed for the future. We have some concerns and we may be coming forward with some legislation to take care of that.

Mr. REGULA. Of WEPCO?

Mr. GENTILE. Yes, and that type of project.

Mr. REGULA. I think what you're saying is that, at least the bill pending in the Senate now, does not adequately address WEPCO.

Mr. GENTILE. We have some concerns.

Mr. REGULA. What about the timelines in the Senate bill that's presently pending as far as the impact it would have on the Clean Coal program?

Mr. GENTILE. Well, the timelines are very tight. There is no question that it is going to be very tight—the program is going to have to move flawlessly. We think there is some opportunity for that to occur. We are looking at two different things. We're looking at the dates. We're also looking at the emissions cap. All of our technologies are going to be beneficial when we look at that cap. We think it is split into the two different areas.

SHARP AMENDMENT

Mr. REGULA. As you know, there is an amendment pending in the House, the so-called Sharp amendment to Title V. One provision would restrict the use of available clean coal funds to only those owners or operators of affected sources, such as in the Phase I reduction requirements. Further, the provision would make available to these owners or operators any appropriations, including funds that are earmarked for, but not yet under contract to, those clean coal projects that you have already selected. I have some concerns about this amendment and what it would do to the Clean Coal program. What is the Department's reaction to that proposal?

Mr. GENTILE. We're opposing the Sharp amendment, but we also have some concerns in a couple of areas. What that bill essentially does is take the 107 plants, and then says that the utilities that own these plants are the ones that are eligible in the program. Well, that precludes the national program, number one. It precludes the broad base of technology that we're striving for in the program, and it doesn't deal with the issue of the cap. We have some problems from that perspective. We also have some problems with the taxation aspect in terms of taxing the SO_2. The Department has taken a strong position on that.

Mr. REGULA. And you've made these concerns known to the Energy the Commerce Committee?

Mr. GENTILE. My understanding is that the Department is taking a position against the Sharp amendment. I'm not sure how it has been conveyed at this point.

INCREASED ELECTRIC DEMAND

Mr. REGULA. At a meeting last week of the Energy Security Working Group, an informal group of members to which I belong, it was indicated that it is highly likely—and this is a result of the statements made by those that appeared on the panel—that electricity demand will outpace supply in this decade, that utilities are losing their flexibility to respond, and we'll need every available option to ensure adequate supplies. Does DOE agree with that assessment? What do you plan, if anything, to do to address the problem?

Mr. GENTILE. We're very concerned that the safety margins, the margins between demand and supply, are getting rather precarious. It is particularly a problem in the Northeast. We see demand increasing, and we don't see the new plants coming on line. It is very difficult for us to even consider taking one megawatt offline. We think that in the long run, especially when you look at it regionally, it is going to have a major impact on this country. We really think that if we were facing an energy crisis in this country, it is not going to be so much at the gas pump; it is going to be at the light switch.

We are very concerned. The NES—the National Energy Strategy—is looking at this particular issue. As we move forward in this process, we'll be dealing with this quite actively.

Mr. REGULA. Would not the Clean Air Act that is pending in the Senate cause some megawattage to go off line, and probably a substantial amount to go to other hydrocarbons as opposed to coal? Would that be a fair statement?

Mr. GENTILE. I would say that we will see a switch to gas among some of the utilities. We are also hearing, most recently, there may be some concerns in terms of deliverability and price. We are going to take a further look at that and see where that is going. I know that the Edison Electric Institute has recently published a study that we're going to be briefed on tomorrow. That is a concern. Do we see plants going offline? I'm not sure that we really see that at this point yet.

CO-FIRING

Mr. REGULA. Have you had any indication that co-firing would offer a potential for bridging between today's prospective requirements in clean air and the time this clean coal technology will come onstream?

Mr. GENTILE. We're, of course, very interested in co-firing. I believe we have four major projects going on with co-firing. By using the gas, we look at some NO_x reductions, and that is basically where we're headed with that. Does it have opportunities in the time frames that we're talking about? Yes, it does. My technical expert over here tells me, "Yes, it does."

OIL AND GAS RESEARCH STRATEGY

Mr. REGULA. That's encouraging. The Ohio Department of Natural Resources has written to me concerning the Oil and Gas Research Strategy. They are concerned that you seem to be focusing on research in the Gulf Coast and Southwestern States and appear to be giving insufficient emphasis to natural gas resources in the northeastern and midwestern States. Do you agree, or would you want to point out that that might not be an accurate opinion?

Mr. GENTILE. What we've done in the oil strategy is try to identify where our most severe problem is. Our most severe problem, given the volume of the reservoirs and fields, and the abandonment rate, is in the States in question. We also have the most data on the States in question. The overall strategy, however, takes into consideration all of the reservoirs and classes, and we have a plan to deal with all of them.

The question is, right now, which do we deal with first? We're trying to deal with the ones where we have the most information. Those are the States of Texas, Oklahoma, and New Mexico.

Mr. REGULA. Well, in a letter from Thomas Byrd, the State geologist of Ohio, he said, "DOE needs to reconsider its research priorities and address the immediate geoscience research needs of Ohio and surrounding States." He points out that to exploit our resources in the midwestern States, we need to have the kind of work that DOE is capable of doing. Are you saying that you're going to put that on the list with all of the rest of the priorities?

Mr. GENTILE. It is on the list. Ohio has one of the highest abandonment rates. They are basically stripper wells in Ohio. They have a very high abandonment rate. In the implementation plan that will be coming to Congress by the end of next month, it will lay out exactly what that strategy is and how we're planning on attacking that. We have had a series of public meetings talking about events and what we're planning on doing. So far, the response to that strategy has been positive.

LEASING AGREEMENTS ON CRUDE OIL

Mr. **Regula**. The Administration has asked Congress for authority to negotiate leasing agreements on crude oil to continue to build the Strategic Petroleum Reserve. According to your report to Congress on alternative financing methods for SPR, the Department has held discussions with several Middle Eastern oil-producing countries, as well as Norway, Mexico, and U.K., concerning the possibility of leasing oil from them to avoid the capital requirements that otherwise would be necessary. Are you actively pursuing that? Will there be a recommendation to the Congress?

Mr. **Gentile**. Yes, we are actively pursuing that authority. We will have that letter to Congress. We would like the authority to look at leasing as an option to avoid the capital costs.

Mr. **Regula**. Are you covering a broad range of countries in this potential such as Venezuela or——

Mr. **Gentile**. Well, the idea here is to go out and find a lease and find the best deal we can cut for the U.S. Government no matter where it is.

Mr. **Regula**. Have you done any analysis on the benefits of filling SPR by exchanging petroleum with reduction of debt? We have a number of debtor nations that do have oil production.

Mr. **Gentile**. I don't think we've done that. I think we are looking to that as one of the options we have available to us.

As a matter of fact, we didn't look at any foreign policy consideration in the entire leasing study. It was strictly on the basis of cost, but I understand what you're saying.

Mr. **Regula**. I think probably it is something that ought to be given consideration along with the leasing as a supplement to it or an alternative.

Mr. **Gentile**. We talked about this somewhat in the last few days given some opportunities we had. The concern seems to be with some of the countries that they need that cash. They're not willing to exchange it for a product. We are looking at several opportunities in Eastern Europe along those lines. So far what we've been finding is that they'd rather have the cash. They need that cash converted to other——

Mr. **Regula**. Take Venezuela, for example, I don't know what their situation is. Let's use Mexico; that is probably a better one. You maybe could have a dual program—some lease and some debt reductions.

Mr. **Gentile**. We've already completed the PEMEX deal with Mexico. I understand the point that you're making. I think that's worth looking at. I hadn't really thought of that. We will look at that if we have the authority.

Mr. **Regula**. Thank you, Mr. Chairman. I'll put the rest of my questions in the record.

OVERVIEW ON CLEAN COAL PROGRAM

Mr. **Dicks**. All right, Mr. Regula.

Mr. Secretary, I regret that I got here late today. I would like to ask just a few general questions. Could you, in a sense, give me an overview on the Clean Coal program? As I understand it, Congress has appropriated approximately $2.7 billion. What have we accomplished? What do we have under contract? Where do you see this program going in general terms?

Mr. GENTILE. We have, in terms of the dollars expended, $1.3 billion in Federal funds matched by $2.3 billion in private funds. Right now we are seeing a cost share that far exceeds our target. Our target was 50/50. We are now at approximately 60 percent cost sharing coming in from the private sector.

We have a number of projects. We have been through three solicitations. We have 38 active projects. Of those 38, we have 16 in cooperative agreement, so we are progressing along that line quite well. We're getting prepared to go out with our fourth solicitation. We'll have another 10 to 15 projects, hopefully, by the first of February of next year.

Mr. DICKS. Could you describe, generally, what kind of projects these are?

Mr. GENTILE. There are a series of projects—atmospheric fluidized bed, pressurized fluidized bed, integrated gasification combined cycle, reburning. There is a whole range in three areas: coal preparation/fuel preparation, combustion technology, and post-combustion flue gas cleanup with all the post-combustion technologies. There is a wide basket of technologies.

Most of them are utility based. We have some industrial activity. We have two projects with steel plants looking at the coking process, direct use of coal, bypassing coking, and the other one is gas cleanup. We have a wide range of activity.

Mr. DICKS. Is most of this aimed at reducing pollution?

Mr. GENTILE. Yes.

Mr. DICKS. All right. When are you planning to complete negotiations on the recently-selected projects?

Mr. GENTILE. December of this year.

Mr. DICKS. So that will go through this year?

Mr. GENTILE. Yes.

Mr. DICKS. How do you feel generally? Are we moving this program too fast? Are we about on the right schedule? Sometimes if you get a lot of money and you spend it—sometimes we have GAO come in a little later on, and they ask a lot of questions about how it was spent. Are we spending this money effectively as far as you can tell?

Mr. GENTILE. The first solicitation was somewhat problematic. I think any program that just starts is a little problematic. I am convinced in looking at the program, really as an outsider now, that the program is well on track. It is offering some technologies that we need to be offering. We see some of these things becoming commercial. A lot of these things came out of our own R&D programs. Basically, we see the track as being the right track. We've seen technologies taken to the commercial development stage, and we're seeing interest overseas in what we're doing.

Mr. REGULA. Will you yield, Mr. Chairman?

Mr. DICKS. Yes, I yield.

Mr. **Regula**. I'm kind of interested in that last statement because it has become quite clear, particularly in Eastern Europe that they've got almost no environmental protection for their industries and, in effect, their people. It would seem to me that that would be a high priority with these new Governments and that clean coal technology would be a highly exportable product to these countries. Do you agree with that?

TECHNOLOGY EXPORT

Mr. **Gentile**. Absolutely. We have an active program in terms of promoting technology export. Some of it is going to try to tie U.S. coal export to technology export. We recently signed a bilateral agreement with Poland, as I'm sure you're aware. We'll be spending about $10 million in Poland to do pollution control on a boiler outside of the city of Krakow. It is probably in the 50 to 100 megawatt range. They've got a very, very serious problem. We're actively working with the Poles. We're also going to be looking at some activity in Eastern Europe.

The Russians have also been interested, because they are having quite a movement going on in Russia. They are fascinated by some of our technologies. We were going to be going over to Russia in a few weeks. That has been postponed right now, but they are actually talking to us about our clean coal technologies.

Mr. **Regula**. Thank you, Mr. Chairman.

WEPCO DECISION

Mr. **Dicks**. Please describe, basically, the WEPCO decision and its impact on clean coal projects. You might just describe for the record the basis of this court case.

Mr. **Gentile**. Well, the court ruled in January, and it was a mixed decision. There was some uncertainty regarding the clean coal projects. We are currently talking to EPA about their interpretation and their interpretive ruling. We have also drafted some language that we may need to fix that problem.

Mr. **Dicks**. Are any current projects being held up because of the decision?

Mr. **Gentile**. There are none currently being held up, but if this becomes a problem and doesn't get resolved in the next few months, we may have some projects in trouble.

Mr. **Dicks**. Why would they be in trouble? Explain what would happen?

Mr. **Gentile**. Well, basically, you've got a situation where there is a requirement for the best available technology to be installed.

Mr. **Dicks**. Right.

Mr. **Gentile**. When you go in and restructure a plant, all of a sudden it kicks in a regulatory framework that, while the exact technology isn't included, some other aspect of the plant might come under that review and, therefore, be required to use on a different type of technology clean up. It is sort of mixing apples and oranges. What we would like to see is that once a plant comes under the Clean Coal Program, that they are excluded from that type of review.

INTERPRETATION FROM EPA

Mr. **Dicks**. EPA states in a letter to the committee that they are working with DOE to resolve treatment of Clean Coal projects under current clean air law and regulations. What is being done?

Mr. **Gentile**. That is very much the case. As recently as this week, there have been discussions going on between our General Counsel and between the EPA General Counsel. We hope to have an interpretation from EPA in the very near future. We'll see how that interpretation comes in, and then we'll decide how to move forward.

Mr. **Dicks**. Well, please keep this Committee informed of what steps you're taking. EPA also states they are working on an interpretive ruling to address EPA's air quality review of clean coal projects. Have you been consulted on this process?

Mr. **Gentile**. Yes. We've had several meetings with EPA on that.

Mr. **Dicks**. Can you give us any idea how this is going to turn out?

Mr. **Gentile**. Not at this point. We'd be happy to inform the Committee of that when we get that far.

[The information follows:]

Discussions With EPA Concerning Air Quality Review of Clean Coal Projects

There are discussions continuing between the Department of Energy and EPA. We will keep the Committee informed of EPA's interpretative ruling concerning the air quality review of Clean Coal projects once a decision is made.

FOREIGN TECHNOLOGY AND LICENSING AGREEMENTS

Mr. **Dicks**. You just mentioned some of this, but let's get this on the record. We understand that the Department is conducting a review of the treatment of foreign technology and foreign licensing agreements, and provisions for the repayment of Government contributions in conjunction with the fourth round of Clean Coal procurements. What is the status of that review?

Mr. **Gentile**. Well, right now we're developing the format for the fourth round. We are looking at both of those issues. They were the subject of two public meetings held in San Francisco and Boston. We will be coming forth with that very shortly in terms of the opportunity notice.

Mr. **Dicks**. You recently held two public hearings on the proposed procurement. What was the response concerning changing these provisions of the procurement?

Mr. **Gentile**. Well, basically, the recommendation from the parties in attendance were that they would prefer that we stayed with the same guidelines that we had in Round Three.

Mr. **Dicks**. Why?

Mr. **Gentile**. They felt that they were applicable enough to the program. The public in attendance was, basically, those interested in bidding on the projects.

DELAY OF ROUND FOUR

Mr. **Dicks**. Okay. Some have suggested delaying the fourth procurement until after passage of clean air legislation. What was the response to that idea at the public meetings?

Mr. GENTILE. That it should not be delayed, nor do we feel it should be delayed. We feel our timelines are such that we don't want to delay this program.

Mr. DICKS. Is the compliance delay from the year 2000 until the end of the year 2003 sufficient to include most technologies contained in the Clean Coal program?

Mr. GENTILE. No, not all of the technologies. There are some that are a little further out. The dates that I read off a minute ago were, in terms of the advanced physical cleaning, somewhere between 1995 to 1998; in chemical biological cleaning, 1996 to the year 2000; atmospheric fluidized bed, 1996 to 2001; pressurized fluidized bed from 1998 to 2003; advanced slagging head combustion from 1993 to 1997; gas reburning, 1995 to 1999; post-combustion duct injection, 1991 to 1995; advanced scrubbers, 1995 to 1999; and integrated gasification combined cycle, 1998 to 2003. Those are the time frames we're looking at when they will become commercially available.

Mr. DICKS. For the record, which ones would be on the borderline or excluded from consideration by such a date? Are there clean coal technology categories that are not represented in the first three procurements?

Mr. GENTILE. There are some technologies that are not included in the first three rounds. Basically, they are integrated gasification combined cycle with fuel cells, MHD, direct coal fired turbines, chemical coal cleaning, bioprocessing of coal, and pressurized fluidized bed combustions with topping cycles.

Mr. DICKS. Do you expect funds to be available from prior solicitations for use on the fourth procurement?

Mr. GENTILE. Yes. As a matter of fact, in Round Four we are going to be pumping in as much as $70 million into that round from previous unexpended dollars.

Mr. DICKS. So you've already made that determination?

Mr. GENTILE. Yes.

CLEAN COAL PROGRAM STAFFING LEVELS

Mr. DICKS. All right. The Statement of Managers of the fiscal year 1990 appropriations bill included an allowance for 80 personnel for the Clean Coal Program. The budget includes only 55 in 1990 and 60 in 1991. For the record, how many personnel or full-time equivalents are assigned to each energy technology center and to headquarters in each of 1989, 1990, and 1991?

How many personnel are assigned to the Clean Coal program from within Fossil Energy R&D floors in each of those years? Are they paid from Fossil Energy funds? If so, how much each year? Please provide for the record measures of clean coal workload over each of the three years to include the number of operational projects, projects in negotiation, procurement activity, environmental work, and other measures, as appropriate, and indicate the manpower assigned to these activities by each ETC and headquarters, for the record. [Laughter.]

[The information follows:]

CLEAN COAL TECHNOLOGY FULL-TIME-EQUIVALENT SUPPORT

Thirty (30) Full-Time-Equivalent's from the Fossil Energy Research and Development organization were used to support Clean Coal in FY 1989. A similar level of support is anticipated for FY 1990 and FY 1991.

CLEAN COAL TECHNOLOGY FULL-TIME-EQUIVALENT SALARY COSTS

The 30 Fossil Energy Research and Development personnel assigned to the Clean Coal program are paid from Research and Development funding at a level of about $1.5 million per year, equating to an average salary/budget cost of about $50,000 per Full Time Equivalent.

CLEAN COAL WORKLOAD MEASURES

The following table summerizes the Clean Coal workload measures:

CLEAN COAL WORKLOAD MEASURES

Workload indicator	1989	1990	1991
Headquarters:			
Operational projects	7	16	38
Projects in negotiation	18	22	15
Total projects	25	38	53
Proposals to evaluate	48	60	60
Project NEPA actions	19	25	35
METC:			
Operational projects	2	2	9
Projects in negotiation	3	8	5
Total projects	5	10	14
PETC:			
Operational projects	5	11	29
Projects in negotiation	15	17	10
Total projects	20	28	39
Project NEPA actions	15	17	22

In addition to the above indicators, all three CCT organizations require personnel to manage the financial aspects of the program, develop and implement technology transfer and outreach activities, provide supervision, administrative and clerical support, and maintain timely and accurate program information.

ALLOCATION OF CLEAN COAL TECHNOLOGY FTE'S

Currently approved FTE allocations for the Clean Coal Program are as follows:

CLEAN COAL FTE'S

	1989	1990	1991
Headquarters	23	23	23
METC	16	16	17
PETC	16	16	20
Total	[1] 55	[1] 55	[1] 60

[1] Total FTE's do not include 3 FTEs within the Office of Environment, Safety and Health.

WORKLOAD

Mr. DICKS. If there's anything else we forgot, throw it in, too. Has the workload gone up?

Mr. **Gentile**. The workload, as we move forward, has a tendency to go up. Yes.

Mr. **Dicks**. Well, then, why are you asking for fewer people?

Mr. **Gentile**. We are using some other people to take care of our peaks in terms of workload.

FOSSIL ENERGY RESEARCH AND DEVELOPMENT BUDGET

Mr. **Dicks**. All right. In looking at this budget, we are talking about some major activities. I also note that in Fossil Energy Research and Development that when we look at some of these key areas—Control Technology and Coal Preparation—we're down from $58 million in 1990 to $34 million in your budget request, a reduction of $24 million. Advanced research is up a fraction. Liquefaction is down from $34 million to $11 million. Combustion is down from $33 million to $18 million, a reduction of $15 million. Fuel cells is down from $38 million to $7 million, or a reduction of $31,000. Heat engines is down from $21 million to $6 million, a reduction of $15 million. Underground Gasification is down by $350,000. MHD is completely eliminated. Surface Gasification goes from $23.4 million to $8.4 million. The total is $275 million in 1990 and down to $110 million in 1991, or a reduction of $164 million. Can you explain that?

Mr. **Gentile**. A lot of these projects were a matter of prioritizing given limited funds. Basically, we have had to make some tough decisions, and we have decided to go with some of our programs that we're wrapping up and not starting some new ones. Also, basically, we have shifted our focus to a little more-near term activity.

Mr. **Dicks**. You're, in a sense, somewhat gutting the coal effort, but on petroleum and gas you actually go up $8 million from $45.3 million up to $53.7 million. This has to say something about your priorities, doesn't it?

Mr. **Gentile**. Well, I think what it says is that we're facing a very immediate problem in terms of the oil program. We're facing an increasing abandonment rate and when those fields are abandoned and plugged, it virtually seals off that resource from further development. We have a very serious problem in oil, and we have tried to shift attention towards dealing with that immediate problem.

Mr. **Dicks**. If coal is our largest resource, why doesn't it make sense to develop technologies to use it more cleanly and efficiently?

Mr. **Gentile**. It does.

Mr. **Dicks**. Are you saying that we're doing everything in the Clean Coal Program and, therefore, we don't need to do it here?

Mr. **Gentile**. No. It says that we had to make some decisions based on resources available. In the oil and gas program we have an immediate problem that requires more immediate attention than we have given it in the past, and that has been our thrust in that area. Coal is our greatest resource, and we feel we have got some good projects ongoing. It is just a matter of having to make decisions and prioritizing those decisions.

Mr. **Dicks**. Well, I notice also that oil shale is reduced from $9 million down to $662,000, Cooperative R&D is eliminated, Program Direction and Environmental Restoration is reduced from $69.2 to

$32.5 million, and Plant and Capital Equipment are down from $12 to $2 million. Can you explain those items? Why the major reductions there?

Mr. GENTILE. Again, it depends on the project. The Oil Shale program, while it is a very exciting project and we have a lot of interest in that project, is a longer-term project. It is something that is a little further out there. We have refocused on nearer term to deal with nearer-term problems. Many of these projects are also projects that are wrapping up, and we have not initiated new projects.

Mr. DICKS. Correct me if I'm wrong. Wasn't it the policy of the Reagan administration for eight years to focus on the long-term? Now all of a sudden we get the new team, and we want to focus on the near term? Is that a change in approach and philosophy?

Mr. GENTILE. I think that is a change in approach. We are quickly learning that we have an impending problem in many areas that is very near term, and we have shifted to focus on those near-term problems.

Mr. DICKS. So we have given up on the long term?

Mr. GENTILE. No, we have not given up on the long term. We have considerable long-term projects, but we have shifted our priorities to fund the nearer-term projects.

Mr. DICKS. Is it not true that many of the technologies in the Clean Coal Program, which Congress initiated and which we both support, came from Federal Coal R&D program?

Mr. GENTILE. Yes. As a matter of fact, about 19 of the 38 projects alone came out of our Pittsburgh Energy Technology Center.

COMMERCIALIZATION OF CLEAN COAL TECHNOLOGY

Mr. DICKS. Is it not true that substantial R&D will be necessary to support the commercialization of clean coal technology?

Mr. GENTILE. Yes, there is some support needed. We have that funded. Waste characterization disposal, future program problem solving—we think we have those covered in the budget request.

Mr. DICKS. Won't technology such as fuel cells, new heat engines, and magnetohydrodynamics contribute not only to solving clean air problems but also global warming concerns?

Mr. GENTILE. Absolutely. There is no dispute with that, Mr. Chairman. Some of these technologies we feel are now reaching the commercial levels in terms of phosphoric acid fuel cells.

Mr. DICKS. MHD?

Mr. GENTILE. MHD is not quite there yet.

Mr. DICKS. It has never been there. It is kind of like reaching out. [Laughter.]

Mr. GENTILE. MHD is a really exciting technology.

Mr. DICKS. I know we've spent a lot of money chasing it around. What are the consequences of reducing the R&D devoted to advanced coal technologies?

Mr. GENTILE. Well, it is going to require greater private participation, and it may delay introduction of some of the newer technologies.

Mr. DICKS. Will the reduction delay the introduction of new technology?

Mr. GENTILE. It won't introduce——

Mr. **Dicks**. It isn't going to help, is it?

Mr. **Gentile**. No, it will not help it. There will be some delays. We're going to try to encourage more private sector participation in the program.

Mr. **Dicks**. Will they continue to support these technologies at current or increased levels when we're decreasing our effort?

Mr. **Gentile**. We've seen some activity in some areas that led us to believe that, yes. Others will probably not, but some areas will see some increased activity.

Mr. **Dicks**. Put in the record any such examples.

[The information follows:]

Fossil Energy Research and Development Technology Not Funded in FY 1991

It is expected that private industry will fund any technology in which they see near term payback. Technical areas in which we would expect industry to continue to fund include: atmospheric fluidized bed combustion, and phosphoric acid fuel cells.

ACID RAIN RELATED TECHNOLOGIES

Mr. **Dicks**. With the expected passage of acid rain legislation, will there be a need to continue supportive technologies which will be used in meeting the requirements of the law?

Mr. **Gentile**. For R&D, yes, those requirements will be completed by 1992. We have those in our request. We think that we will have those well covered.

Mr. **Dicks**. Could such requirements actually increase?

Mr. **Gentile**. Yes, especially in terms of the emission cap-related types of R&D.

Mr. **Dicks**. Are there acid rain-related technologies that you have supported in the past that will no longer need support?

Mr. **Gentile**. Especially the acid rain flue gas cleanup because we think we've got that project pretty well completed.

Mr. **Dicks**. Okay. All right.

The committee will adjourn and start again at 1:30.

[Brief recess taken.]

Mr. **Atkins** (acting chairman). The hearing will come to order. Welcome back.

GAS PROTECTION PLAN

Can you tell me the status of the gas protection plan?

Mr. **Gentile**. We're having some increasing activity on our boundaries on the oil shale reserves. In 1989, we had 35 wells drilled, 15 of which were within a mile or less of our boundaries. We know of 88 wells that are planned for 1990, 27 of which would require communitization. There is a lot of activity in that area. We are somewhat concerned about our boundaries and the drain-off of gas.

Mr. **Atkins**. Do you have specific projections of production and revenue by year for that part of the plan?

Mr. **Gentile**. We could supply for the record the production of our wells. The activity from the surrounding wells, however, is increasing so rapidly that I'm not even sure that we could do that at this point because we are seeing so many wells go down. We could tell you what our production looks like.

[The information follows:]

Production and Revenue

Implementation of the Department's gas protection plan will yield the following production and estimated revenue streams:

Year	Production (million cubic feet)	Revenue
1991	3,104	$3,725,000
1992	6,410	8,141,000
1993	13,728	18,396,000
1994	13,423	18,926,000
1995	11,388	16,854,000
1996	8,665	13,431,000
1997	7,109	14,218,000
1998	5,846	12,335,000
1999	4,813	10,685,000
2000	3,976	9,463,000

Only the first 10 years are shown. Production and revenues will gradually decline throughout project life of 20 years. Revenues are based on a gas price of $1.20 per thousand cubic feet in 1991 with moderate annual increases.

GAS DRAINED FROM GOVERNMENT LANDS

Mr. **Atkins**. What are your estimates of the amount of gas and the value that will potentially be drained for Government lands?

Mr. **Gentile**. Well, without any further activity, by the year 2015 we could lose between 25 to 58 billion cubic feet by that year.

Mr. **Atkins**. And the rough value of that?

Mr. **Gentile**. I'm not sure. That would be between $35 and $87 million. Right now, in today's dollars, if no additional activity were to occur, it would be a little over $8.75 million, given the price of gas at about $1.19.

Mr. **Atkins**. Do you think that estimate on the amount is pretty good? You're comfortable with that estimate?

Mr. **Gentile**. That is a projection.

Mr. **Atkins**. That sounds real low to me.

Mr. **Gentile**. That is a projection.

Mr. **Atkins**. Where did that projection come from?

Mr. **Gentile**. It came from our activity out there. It is our engineering analysis out there. It is based on what we see happening right now. We can't project beyond that. There are a couple of major pipelines out there. If the market holds and price holds, we will probably see more activity. It has really happened in the last couple years, and we can't react fast enough in terms of projecting.

Mr. **Atkins**. That strikes me as a very low figure from what I understand.

Mr. **Gentile**. That is the best we have at this point. I'd be happy to go back and look at that, Mr. Chairman.

Mr. **Atkins**. I'd appreciate it if you could do that for the record, and indicate how you arrived at your draining estimates.

Mr. **Gentile**. Okay. Will do.

[The information follows:]

NAVAL OIL SHALE RESERVES DRAINAGE

Basis	Naval oil shale reserves drainage thru 2015 (million cubic feet)	Lost revenue (million)
Existing wells, to date	3,650	$5.475
Existing wells, no future activity by private industry or DOE	7,353	10.030
Existing wells, scheduled fiscal year 1990 wells by private industry, no DOE activity	19,584	29.376
Existing wells, full development by private industry, no DOE activity	58,656	87.984

Revenues are based on an average gas price of $1.50 per thousand cubic feet over the period 1989-2015. Drainage estimates are based on the results of simulation studies performed by the Department in 1985 and 1987.

REPROGRAMMING

Mr. ATKINS. Are you prepared to spend more funds in the immediate future through reprogramming in order to prevent drainage?

Mr. GENTILE. Yes, we are. We are preparing right now a reprogramming in the amount of $4,440,000 to take care of this problem in that area for FY 1990. We hope to have that to the Committee for FY 1990 by mid-summer.

Mr. ATKINS. The amount on that reprogramming?

Mr. GENTILE. $4,440,000.

Mr. ATKINS. What do you figure the total cost will be of a program to prevent drainage?

Mr. GENTILE. Well, capital cost for implementation of a plan would be about $76 million over the next four years.

Mr. ATKINS. $76 million over the next four years?

Mr. GENTILE. Yes, for our total plan.

Mr. ATKINS. And your estimate of the loss?

Mr. GENTILE. The figure I gave you was assuming the activity was staying stable. As we project more of what the private sector is doing, those numbers will go up. Assuming no additional DOE activity, it looks iike in excess of 12 billion cubic feet by 2015 and could go much higher than that.

Mr. ATKINS. It could go up to 35 billion by your projections.

Mr. GENTILE. It could go up to about 58 billion for—yes, it could go up quite high by that time, assuming no additional Government activity.

Mr. ATKINS. You are going to fund the first elements for reprogramming. How are you funding the rest of it?

Mr. GENTILE. We are reprogramming that amount of money in FY 1990 to take care of our immediate problem to protect our boundaries. Then, as we see this evolving, we'll put more money in the FY 1992 budget to make sure that we protect our gas.

Mr. ATKINS. So you expect to put in a total amount sufficient to protect your gas?

Mr. GENTILE. As we have those funds available, yes.

Mr. ATKINS. Do you have anything in this year's budget?

Mr. GENTILE. No.

Mr. ATKINS. Why not?

Mr. GENTILE. We thought that we could handle the problem with the $4.4 million in the FY 1990 reprogramming.

Mr. ATKINS. But can you?

Mr. **Gentile**. We think we handled the immediate problem.

Mr. **Atkins**. I'm not sure I understand what you mean by "the immediate problem."

Mr. **Gentile**. We think that we can deal with the $4.4 million to handle it through this year. Again, when looking at the priorities, the gas plan was not a priority in preparing this budget. These funds were for communitizing the wells on our border.

Mr. **Atkins**. Well, let's assume that you had the real financial incentive structure that private enterprise would have. What would be the return on your investment for this coming year of putting in your first year? It's a three-year program to totally protect your gas protection.

Mr. **Gentile**. Part of our problem right now is the prices aren't that good out there. We would probably not go into major activity because we wouldn't expect the income. We're looking at prices right now of about $1.19, I believe, so it is not attractive enough to really push it at this point.

Mr. **Atkins**. What is the payback period for the $4.4 million?

Mr. **Gentile**. I don't think we have a payback because we're protecting our boundaries.

Mr. **Atkins**. No, but you have an estimated loss and, therefore, lost revenues.

Mr. **Gentile**. We'd have to provide that for the record. I don't know if we can do it that way.

Mr. **Atkins**. Plus you get additional revenue from the gas site. Is there anybody here who would know? You must have that?

Mr. **Gentile**. We'd have to provide it for the record, Mr. Chairman.

[The information follows:]

Payback of $4.4 Million Reprogramming

The NOSR Gas Protection Program is designed to prevent the drainage and ultimate loss of natural gas resources underlying the government property to contiguous private developers. In the past eight years, it is estimated that drainage has resulted in the loss of over $5 million worth of government natural gas. This development has intensified measurably in the past two years and could account for as much as $55 million in drainage losses in the next ten years.

The $4.4 million reprogramming is specifically for communitization (joint ownership) of wells proposed by private developers for drilling in areas contiguous to the government's property. Twenty-seven such wells have been proposed by private developers for drilling in FY 1990. Failure to participate in the cost of these wells would result in a three hundred percent penalty in revenues before the DOE would be entitled to share in the production. In otherwords, if DOE were a 50% owner of the wells, as a total cost of $4.4 million, the penalty would be $13.2 million in production revenues before the government would be entitled to its share of production. With the very rapid decline of production experienced by these wells, the government would likely never be able to recoup its share of the gas over the remaining life of the wells.

If DOE does participate in all 27 wells, it will collect receipts that are estimated to be $20.4 million over twenty years. Payback of the initial investment would be made in approximately 5.5 years and the discounted net present value of the investment would be $2.9 million. The government's share of production over this period is estimated to be approximately 9.6 billion cubic feet.

LONG RANGE GAS PROTECTION PLAN

Mr. **Atkins**. I'm looking at your gas protection program long range plan for 1989 to 2011.

Mr. **Gentile**. Yes?

Mr. ATKINS. There is a total cost of $130 million, total revenues of $257 million, net revenues of $127 million. You have an NPV, assuming a 10 percent, to $30.1 million, a rate of return of 66 percent, and a payout of 5½ years. Is that correct?

Mr. GENTILE. Yes, sir. That is what we projected for the long term.

Mr. ATKINS. Given that rate of return which seems rather extraordinary, why aren't we accelerating that program?

Mr. GENTILE. This would be a long-range plan for our wells. The reprogramming is geared towards communitizing wells that are draining on our borders. It is a little different approach. Should we put in a plan in place to go out and actively drill and develop the field? That's what we're looking at here.

Mr. ATKINS. Why aren't we putting a program in place to go out and drill and actively——

Mr. GENTILE. We're looking at this year's budget cycle. Again, it was a matter of prioritization.

Mr. ATKINS. It seems as though there is a substantial return to the Treasury. If you move back your total NOSR natural gas development program, you've got a payout of 8½ years there and a rate of return of 49 percent. I can't understand why we're delaying the implementation of that program.

Mr. GENTILE. We have two things at play here, Mr. Chairman. On the gas protection plan, what we're trying to do is prevent an immediate problem and prevent drainage of our reserves by the immediate problem. That is the objective of the gas protection plan.

Mr. ATKINS. Can that plan be carried out within the existing legislation?

Mr. GENTILE. With the reprogramming, yes.

Mr. ATKINS. Just with the reprogramming?

Mr. GENTILE. Yes.

Mr. ATKINS. And that's the total amount that you need?

Mr. GENTILE. For short-term prevention of drainage.

Mr. ATKINS. Okay.

Mr. GENTILE. This is a developmental program. It talks about, "Should we go out and do it and develop the resource base?" We're looking at a little different situation.

Mr. ATKINS. You've got two separate plans. The first one I read from is your NOSR gas protection program.

Mr. GENTILE. Yes.

Mr. ATKINS. As I'm reading from your sheet, "long-range plan, 1989 to 2011, number of wells 162." It is my understanding that that is solely to protect your gas. Is that correct?

Mr. GENTILE. I was looking at the next chart, which is the gas development plan.

Mr. ATKINS. Let's go through this plan. Given these numbers, you're not going to come close to reaching this with your reprogramming figure of $4.4 million.

Mr. GENTILE. No, this is a long-term program of 162 wells. The reprogramming is really very short term and deals with immediate problems.

Mr. ATKINS. I understand. That's the short-term immediate problem. Then you've got a long-range plan for gas protection.

Mr. **Gentile**. That's this one, yes.

Mr. **Atkins**. Which is this one. You have no funds in the budget to implement this one?

Mr. **Gentile**. No.

Mr. **Atkins**. Is that correct?

Mr. **Gentile**. That is correct.

Mr. **Atkins**. All right. Given the rate of return from this, why don't you have funds in the budget for this?

Mr. **Gentile**. Again, simply, Mr. Chairman, it is a matter of prioritization. Given the expenditure, it was decided that the resources just weren't there.

Mr. **Atkins**. It's an expenditure, but for the expenditure of $155 million, you get $257 million back for net revenues of $120 million. In my book, particularly in this business, that is a pretty good deal.

Mr. **Gentile**. It is.

Mr. **Atkins**. I don't understand why the priority wouldn't be placed on that.

Mr. **Gentile**. I agree with you that the return is substantial. It's attractive. It is merely a matter, however, of the expenditure. Did we want to go through with this expenditure at this point in time? The Department decided this was not a priority.

Mr. **Atkins**. In order to implement this plan, what would your first-year cost be?

Mr. **Gentile**. We would probably have to supply that for the record.

Costs of Implementation

The Department's costs to implement our gas protection plan in FY 1991 would be $10.7 million and in FY 1992 would be $34.2 million.

COST OF IMPLEMENTATION

Mr. **Atkins**. Roughly?

Mr. **Gentile**. Just a rough estimate, we're probably looking at about 30 to 35 percent up front in your first year.

Mr. **Atkins**. Okay. So that would be 35 percent of what?

Mr. **Gentile**. $155 million.

Mr. **Atkins**. $155 million, which would——

Mr. **Gentile**. About $60 million.

Mr. **Atkins**. About $60 million. Okay. Now if you were to take that $60 million and expend it this next year, what would your return be in the first year?

Mr. **Gentile**. Not very much. You'd have all your capital costs loaded at the front end.

Mr. **Atkins**. And it would take you how long——

Mr. **Gentile**. You're probably looking, I would say, at about five and a half years. It would probably be at about the end of the second year that we'd be really drawing the gas.

Mr. **Atkins**. How long would it take you to amortize the $60 million?

Mr. **Gentile**. Well, if you're looking at a four-year program where you take your amortization—you'd have to redo the figures based on your 5.5 years. We'd have to recalculate that for you.

Mr. **Atkins**. Okay. It would take you roughly four years to——

Mr. **Gentile**. On $60 million, it would probably take you about four years to make the entire investment.

Mr. **Atkins**. Okay. And if you did that, then you'd have total revenues beyond the four years after you amortized it of how much?

Mr. **Gentile**. How much revenues?

Mr. **Atkins**. Yes.

Mr. **Gentile**. Well, if we're projecting total revenue—off the $60 million or the total?

Mr. **Atkins**. Off the $60 million.

Mr. **Gentile**. Well, you would probably assume in your $60 million that you'd have some capital costs, facility costs, and networking. To take this and divide it by 30 percent is not the right way to do it. We'd have to recalculate these figures.

Mr. **Atkins**. You'd have to do the whole thing?

Mr. **Gentile**. Yes.

Mr. **Atkins**. It seems to me, given the potential revenues there, that it ought to make sense to set up some kind of self-financing basis for this and to do it on that basis. Is that something you have explored?

Mr. **Gentile**. We have not explored that. It is an interesting concept. One of the difficulties we have there right now is that the gas price in the Rocky Mountains, especially in that area, is a little shaky. There are two major gas transmission lines coming through that area, right on the periphery of that area, and there is a lot of activity, but the gas rates are still a little shaky.

Mr. **Atkins**. Would that give you an option to transfer the gas to the Defense Department?

Mr. **Gentile**. Yes. We could do that, yes.

Mr. **Atkins**. How much?

Mr. **Gentile**. If they were willing to take it, we could——

Mr. **Atkins**. You could off-load all of it at what price?

Mr. **Gentile**. Fair market.

Mr. **Furiga**. A negotiated price with DOD.

Mr. **Atkins**. And what would be the market for——

Mr. **Gentile**. The market right now is $1.19.

LONG RANGE DEVELOPMENT PROGRAM

Mr. **Atkins**. Now for your long-range development program, would you need legislation to do that program?

Mr. **Gentile**. Yes, we do.

Mr. **Atkins**. You would need legislation?

Mr. **Gentile**. Yes, we have the responsibility to protect our reserves from drainage. That is the authority we have.

Mr. **Atkins**. How sure are you that extensive gas reserves exist?

Mr. **Gentile**. Well, we are relatively certain. We have been doing some engineering, but they are minimal. We'd like to do some more. We are encouraged by the activity on our borders. There is a substantial amount of activity on the borders. As a matter of fact, Mr. Chairman, in the reports that you are referring to, I think you can see what our development activity has been like. While our engineering has been minimal, we don't think that that development would be going on if there wasn't a lot of interest there.

Mr. **Atkins**. Okay.

Mr. **Gentile**. By the way, I've just been handed a note here. One of the developers on our border is telling us that there are about 3 trillion recoverable.

Mr. **Atkins**. Three trillion cubic feet?

Mr. **Gentile**. That is their estimate of recoverable gas in informal conversations we've had with them.

Mr. **Atkins**. On your land?

Mr. **Gentile**. No, in that area.

Mr. **Atkins**. How much of that would be——

Mr. **Gentile**. Well, there is drilling around our borders on several different sides, I'd say that we probably straddle that basin on both sides.

Mr. **Atkins**. So even given the level of activity around you, your $4.4 million is still sufficient to protect your fields?

Mr. **Gentile**. We think it is sufficient right now, yes, in the near term.

Mr. **Atkins**. Near term being?

Mr. **Gentile**. One year.

FUEL CELLS

Mr. **Atkins**. In your budget on page 58, you make the following observation, and let me quote, "International fuel cell development efforts are underway, but the U.S. is the current world leader. If this lead is maintained and the development goals are met, the U.S. could become the leading exporter of this technology." Could you explain to us how reducing the program from $38 million to $7 million will help us maintain our world leadership?

Mr. **Gentile**. This is Marvin Singer. Joining me on the other side is the Deputy Assistant Secretary for Coal Technology.

Mr. **Atkins**. If you could just, for the stenographer, identify yourselves from the hot seat.

Mr. **Singer**. Marvin Singer.

Mr. **Siegel**. I'm Jack Siegel.

Mr. **Atkins**. And if you could identify your titles as well.

Mr. **Singer**. Deputy Assistant Secretary for Oil, Gas, Shale, and Special Technologies.

Mr. **Siegel**. I'm Deputy Assistant Secretary for Coal Technology.

Mr. **Gentile**. We've seen a lot of activity in the fuel cell area. We have seen increased activity in some other countries. We are looking, basically, at three different types of fuel cells. The first type of fuel cell is a phosphoric acid fuel cell. We think that we're going to be completing our funding of that project in April of 1992. It has been a multi-year program. We think that program is ready to go commercial.

In the molten carbonate fuel cells area, we are about five years behind the phosphoric acid fuel cells. We are, right now, selecting two firms to do a scale-up on that technology and one firm for a generic R&D program. In 1991, it would allow two firms to do scale-ups but not the generic R&D.

In the advanced concepts, basically, solid oxide fuel cells are quite a bit farther into the future. They are basically very high temperature, high efficiency. Two major contractors are Westinghouse and Allied Signal. The FY 1991 funding would allow us to continue with one of those contracts.

Mr. ATKINS. So you're not going to have much of a continuation though?

Mr. GENTILE. We will have continuation with one of the projects.

Mr. ATKINS. Okay. Tell me what your understanding is about the major fuel cell developers. They are already receiving foreign funds for development of the technology. What would you guess? Is that correct?

Mr. GENTILE. My understanding is that the Europeans have just recently put a fair amount of dollars into fuel cells. So have the Japanese, both on the part of the government and the private sector. There is a fair amount of activity in that area, yes.

Mr. ATKINS. So what is the effect of our reduction of our U.S. support likely to be in terms of their dependence on foreign participation in the technologies?

Mr. GENTILE. Several of the companies working in that area are multi-nationals. They're getting funding both from us and from the foreign investors.

Mr. ATKINS. So if we reduce ours, they'll just increase the foreign share?

Mr. GENTILE. Perhaps. I'm not sure. We've seen that increase in activity. Whether we reduce or whether they'll increase, I'm not sure.

Mr. ATKINS. The net effect of that will the loss of American control over the technology.

CONTROL OVER TECHNOLOGY

Mr. GENTILE. Well, not really. I don't think it's a case of control over technology. The dollars coming in to an R&D project really don't impact the control of the technology. The control of technology is a function of ownership of the company.

Mr. ATKINS. So you think the dollars coming in have no effect on patent positions?

Mr. GENTILE. No, they would. There is DOE money involved, and we have some stand in terms of patent.

Mr. ATKINS. And if we don't have DOE money, we have no standing in terms of patents, correct?

Mr. GENTILE. The company would have standing; DOE would not have standing.

Mr. ATKINS. So aren't we looking at a situation very similar to the VCR where we pump in all this money for development, we get the technological edge, and then right as we're on the finish line we collapse right in front of the line and allow the Japanese to pick up, shoot across the line and pick up the gold?

Mr. GENTILE. There is that danger.

Mr. ATKINS. How significant do you think that danger is?

Mr. GENTILE. Well, in the U.S. market, it is one situation. In the international market, it is another. Our protection is basically the U.S. market. We can protect some things here. We don't have that opportunity or ability to protect outside the U.S., as much.

Mr. ATKINS. Well, we do have the opportunity, it is just not as great.

Mr. Gentile. Yes. Right.

Mr. Atkins. The lack of protection would only be an issue if people violated international laws and agreements, correct?

Mr. Gentile. It also depends on how the patent waivers are structured.

Mr. Atkins. But if they develop the technology from this point on, they pick up the whole enchilada, right?

Mr. Gentile. They could if they were foreign owned, yes.

Mr. Atkins. Is there any way under which they wouldn't?

Mr. Gentile. Marvin is telling me that they have agreed to split the foreign market and compete. The only one that is reserved is the Japanese market.

Mr. Atkins. That is assuming that we're in at the levels we've been in in the past—$38 million. When we come down to $7 million, that is going to change that substantially, isn't it?

Mr. Gentile. It might have an effect on the competitive edge of those companies.

Mr. Atkins. How would it not have any effect?

Mr. Gentile. Only if they solicited private funds from the U.S. private sector.

Mr. Atkins. What is the likelihood of that?

Mr. Gentile. We see some activity. We see some commercialization. There is some activity also on the part of the Electric Power Research Institute and Gas Research Institute.

Mr. Atkins. But they're already getting those funds. The other private funds they're getting, they're getting from foreign sources.

Mr. Gentile. I'm not sure of the outcome of the foreign sources.

Mr. Singer. I don't think we know.

Mr. Gentile. I don't think we know the answer if they all come in from foreign sources.

Mr. Atkins. It is our understanding that it is predominantly foreign sources. I'm kind of at a loss as to why, having taken the program up absolutely to the end line, we're now going to turn it over to the Japanese. Why didn't we give it to the Japanese in the first place? Why don't we just cut out a check to the Japanese and send it to them instead of going through this charade which seems particularly aggravating?

PHOSPHORIC ACID FUEL CELL

Mr. Gentile. Again, I think, Mr. Chairman, as a matter of priorities within the Department, in terms of funding those projects which we felt were nearer-term and were not commercial, that was the decision that was made. We think that the phosphoric acid fuel cell is on the verge of being commercial.

Mr. Atkins. Let me ask you this: Do you feel that this technology is not commercial?

Mr. Gentile. No. The phosphoric acid fuel cell, we think, is already commercially available. It is already being used commercially.

Mr. Atkins. Right.

Mr. Gentile. So we don't think there is any reason to fund that beyond the end of our project in 1992. The other projects are further out.

LONG TERM RESEARCH

Mr. **Atkins**. So your suggestion is because they are further out, you're just going to drop them?

Mr. **Gentile**. No, you're not going to drop them. We've tried to balance and mix as best we can given the resources we have available.

Mr. **Atkins**. I'm kind of puzzled. I know I've heard the President a number of times on national policy, on competitiveness, and Secretary Brady's big emphasis has been that American industry is too focused on the short term. We're too driven by the quarterly revenue projections. We now have some areas of long-term research. We knew when we got into these things that it was going to take them a period of time to get to commercialization.

So what the Administration is saying is, you know, "Read our lips, and do as we say; don't do as we do," that we're going short term, having budgeted and made all of the commitment for the long term at the same time that we're telling you, the private sector, to go long term.

Mr. **Gentile**. I think we're trying to mix and blend among the resources that we have. I agree with you that we have concentrated more in the short term because we're trying to deal with some very short-term problems.

Mr. **Atkins**. If we're the leader, why are we getting out of it? Just at the time that people are starting to make an investment, and are getting into the race, we're making the decision to get out. Why is that?

Mr. **Gentile**. Again, I think it is strictly on the basis that the one project, the one phosphoric acid fuel cell project, is at the commercial level right now. The others are just beginning. Rather than fund beginning projects at this point in time, we decided we had priorities in other areas.

BUDGET PRIORITIES

Mr. **Atkins**. Can you tell me what other areas you put your priorities into? You've got things that are a nine-month payback that aren't a priority. You've got things that are a four-year payback that aren't a priority. The priority must be a real bonanza.

Mr. **Gentile**. No. I think the priority right now is a major shift into the oil and gas program to protect the abandonment and plugging in those reservoirs where we have such a significant problem. That is one of our major priorities.

Mr. **Atkins**. And how much money has gone into that?

Mr. **Gentile**. $23 million into the overall plan. It was $54 million in oil and gas.

Mr. **Atkins**. I don't think that there is any disagreement on that, but it doesn't seem to make sense that in order to meet that priority, we should strip everything else and eliminate things that have such an enormous potential for payback, even by your own estimates.

Mr. **Gentile**. Well, Mr. Chairman, we have to compete not only within our own basket of activities, but also within the Department. The Secretary had priorities. The President had priorities. That is how this was hammered out.

Mr. **Atkins**. Do those priorities make any sense to you?

Mr. **Gentile**. I don't know what some of those priorities are, sir.

Mr. **Atkins**. Can you imagine anything that would be of greater importance?

Mr. **Gentile**. I think there are some activities in the Department that are a significant priority. One is the environmental cleanup that is going on in the Department right now, the move toward a national energy strategy in terms of developing where we need to be going with our nuclear programs in addition to our fossil programs.

NATIONAL ENERGY STRATEGY GOALS

Mr. **Atkins**. Okay. In your Congressional briefing that you did for the National Energy Strategy, DOE listed three policy goals: assure adequate supplies of energy of reasonable cost, maximize efficiency in energy production and use, and improve environmental quality. Now wouldn't this particular program—the fuel cell technology—achieve all three of those priorities?

Mr. **Gentile**. I think it would as would most of our other technologies. Most everything in Fossil, in terms of the R&D area, is geared towards efficiency, environmental areas, and security. It is still a matter of making priority decisions among those in that range.

FOREIGN FUEL CELL FUNDING

Mr. **Atkins**. Tell me how many other countries are funding fuel cell R&D.

Mr. **Gentile**. I know there is some activity in the European community and also the Japanese.

Mr. **Atkins**. So about how many countries are we talking about?

Mr. **Gentile**. Japan is very active in all three areas.

Mr. **Atkins**. What is happening to Japan's funding?

Mr. **Gentile**. Japan's funding is about $20-some million a year.

Mr. **Atkins**. And it's going to what?

Mr. **Gentile**. It's going into all three areas.

Mr. **Atkins**. No, I mean what is it being increased by?

Mr. **Gentile**. Between 1984 and 1989, it has been $26 million a year.

Mr. **Atkins**. But they have major increases now?

Mr. **Gentile**. The private sector seems to be doing some increased spending, about three times that of the Japanese government.

Mr. **Atkins**. But for molten carbonate fuel cells, for instance, your estimates that I have here are between $100 and $150 million per year, with the government being probably about——

Mr. **Gentile**. To date, the DOE, through 1990, has spent $472 million. The private sector has spent $467 million. The cumulative Japanese expenditure has been about $205 million in the government sector and has been about $300 million in the private sector. In Europe, the total seems to be about $88 million, all of Europe.

Mr. **Atkins**. But to drop us down to $7 million will virtually take us out of the picture. I mean, the cumulative past is irrelevant at this point to our current positions. If we pull the plug on the thing, they are going to come roaring by us. The Japanese and the Europeans are increasing.

Mr. **Gentile**. We have a considerable amount of expenditures also in the U.S. private sector.

Mr. **Atkins**. A lot of those expenditures are coming with Japanese funds.

Mr. **Gentile**. That's quite likely.

MOLTEN CARBONATE FUEL CELLS

Mr. **Atkins**. Can you tell me in the molten carbonate system, what effect has reducing the funding for stack development from $16.5 million to $5.6 million had on the program?

Mr. **Gentile**. We have sufficient funding through April 1992 to complete one of the projects, the IFC project. We think that there is sufficient funding in Westinghouse in 1990 to build a 375 kilowatt building block stack.

Mr. **Atkins**. Wait a minute. You're talking phosphoric acid. I'm talking molten carbonate.

Mr. **Gentile**. Oh, I'm sorry. I'm looking at phosphoric acid fuel cells where we would be eliminating one of the two contracts.

Mr. **Atkins**. You want us back to that phosphoric.

Mr. **Gentile**. I'm sorry. [Laughter.]

For molten carbonate fuel cells, we would be losing one of three. We're doing, in 1990, some work in stack research and power plant development. The proposals have been received, and contracts are expected to be awarded before the end of the year. We think the FY 1991 request will be sufficient to fund the first part of the program, with funding support expected from both cost sharing and GRI and EPRI.

Mr. **Atkins**. The proposals, though, were assuming full funding for this. Now with the reduction, what is that going to do?

Mr. **Gentile**. We have sufficient funding for three projects in 1990 and two in 1991. The effect is we're reducing from three projects to two.

Mr. **Atkins**. Oh, can you tell me why molten carbonate fuel cells are an attractive technology in the first place?

Mr. **Gentile**. For that question, I'd like to turn to Marvin Singer, and let Marvin explain it to you.

Mr. **Singer**. They operate at a higher temperature than the phosphoric acid fuel cells and have the prospect of a higher efficiency.

Mr. **Atkins**. Now what about the effect of our reductions? If we continue at this reduced level, do you believe that we'll stay competitive with the Japanese? We're talking how many years away from commercialization in the molten carbonate systems?

Mr. **Singer**. The molten carbonate systems won't be commercial until later in the 1990s.

Mr. **Atkins**. About how many years roughly?

Mr. **Singer**. Towards the end of the decade, I would guess.

Mr. **Atkins**. Seven or eight years? Is that a reasonable estimate?

Mr. **Singer**. Reasonable.

Mr. **Atkins**. Okay. That delay from $16.5 million to $5.6 million would that delay the commercialization by how much?

Mr. **Singer**. That is really hard to estimate. We hope that our commercialization efforts will be kept on track.

Mr. **Atkins**. I'm not sure I understand how that could be possible. I'm sure you can hope that they would stay on track.

Mr. **Singer**. Through the evaluation process, we hope we'll pick the performers that are best able to commercialize the technology. This will be a competition.

Mr. **Atkins**. But you still are focusing on different contractors that are specializing in different areas, and you don't know, and will have no way to tell, which avenues are likely to yield the fastest breakthroughs. Do we?

Mr. **Singer**. No, that's correct. We have no way to tell in advance.

Mr. **Atkins**. So it's strictly a roll of the dice, which is why we started the program in the first place; to go with a number of contractors pursuing different technologies.

Mr. **Gentile**. I would say that as we get down closer to the project, I wouldn't characterize it as a roll of the dice, but I would say that if we had all of the money that we'd like to have in every area, that we would certainly fund several things until they were no longer viable. When we are, however, operating on limited resources, we would fund that project, or those projects, that seem to have the most viability.

Mr. **Atkins**. Let me move on from that, if I can. Is there anything else you want to add?

Mr. **Gentile**. No, that's fine. [Laughter.]

Mr. **Atkins**. You can earn your money today. [Laughter.]

FOSSIL ENERGY PERSONNEL

Something a little easier. In February of 1989, there were four consultant and political Schedule C personnel at Fossil Energy. As of February 1990, the figure is 12. That is 12 people out of about 800 people? Is that 800 total personnel?

Mr. **Gentile**. It is 1,000.

Mr. **Atkins**. Out of 1,000?

Mr. **Gentile**. Yes. I think the number may have been 12 in February. There are nine right now today. There are nine and one non-career SES. That makes 10. There are nine Schedule Cs and one non-career SES.

Mr. **Atkins**. What happened to the other four? They came on and then went——

Mr. **Gentile**. I was one until I was confirmed. One consultant left. The number that you're working from, was a cumulative number of 12 which included nine schedule Cs, two consultants, and one non-career SES. The two consultants have dropped out. You now have a total of 10.

Mr. **Atkins**. Can you tell me what information these people provide that can't be provided by career personnel?

Mr. **Gentile**. Well, I think they have a wide range of skills. Some of them have unusual skills that they bring to the Department, both in terms of specialties in electricity and power generation, some in terms of oil and gas and they have an independent perspective. There are a wide range of skills.

Mr. **Atkins**. And those are skills that you can't find?

Mr. **Gentile**. No, some of them are available, I'm sure, in the career ranks. The question is whether or not the Department wants Schedule Cs, and the answer is "yes."

Mr. **Atkins**. The Department does want Schedule Cs?

Mr. **Gentile**. Certainly. Any Administration has a certain number of Schedule Cs.

Mr. **Atkins**. All right. You're aware in 1986 a Congressional committee had GAO investigate the Bureau of Land Management because they had 14 schedule Cs out of 8,700 people.

Mr. **Gentile**. No, I'm not aware of that.

Mr. **Atkins**. You had, in the total Energy Department, 110 in November of 1988. I might add that that was a record high at that point for Schedule Cs. They've never had this many since we've had this system. You are now up to 217 overall in the Department. Do you plan, in Fossil Energy, to continue to add Schedule Cs?

Mr. **Gentile**. There is no plan to add Schedule Cs. We would add Schedule Cs, or delete Schedule Cs, as we felt the need arose, or as the Department felt that need arose.

Mr. **Atkins**. And the criteria that you use to determine whether you go to a Schedule C——

Mr. **Gentile**. I think it is a combination on the part of parties within the Administration, and the President wanting to put his Administration in place. Others would have unique skills that they bring to the Department or to the Secretariat.

Mr. **Atkins**. Were any of Schedule Cs you had, the 14 that were on your rolls, not politically active and not involved in political fundraising or organizing?

Mr. **Gentile**. I'm sure there were some that were not because there were some that were Hatched, so they would not have been.

Mr. **Atkins**. But they had been, previous to being Hatched, politically active?

Mr. **Gentile**. I don't know the answer to that. Some may have been; some may not have been. I really don't know. If you're asking is the criteria that they were fundraisers or actively working in campaign, is that the criteria for being a Schedule C, I don't believe so. I think there were those Schedule Cs who were active; there were those who weren't.

Mr. **Atkins**. What effect do you think the increased use of Schedule Cs has had on the moral of your career employees?

Mr. **Gentile**. I don't think it has been detrimental. I think most of the schedule Cs that we have——

Mr. **Atkins**. Has it been positive for them?

Mr. **Gentile**. I think that some of the Schedule Cs bring different perspectives into the organization and a different skill mix than we currently have.

Mr. **Atkins**. I just wish you could see the expressions on the faces behind you. I have to suggest to you that the trend is troubling, and it certainly was not what was intended when the system was reformed in 1986. I'm pleased that you're down somewhat from the 14, but it is certainly a troubling trend.

Mr. **AuCoin** (acting chairman). Mr. Gentile, how are you?

Mr. **Gentile**. Fine, thank you, Mr. Chairman.

Mr. **AuCoin**. We're tag-teaming you. [Laughter.]

LIQUIDS PROGRAMS

Let's turn to liquids programs. For the past two years, this hearing has discussed the problem of a dependence on foreign sources of oil for liquid fuel requirements. We focus on the need to develop alternatives to oil-based fuels. This year, you know, and I know, that our import situation is even worse than it was. Except for increased emphasis on oil production, the Administration continues to ignore the problems in the liquid fuel area.

Severe reductions are suggested in this request for coal liquification, oil shale, and liquids from methane. Are those actions consistent, when you really think about it, with the recommendations of the National Research Council, for example, and its report on liquid fuels, which was recently completed?

Mr. GENTILE. Well, the National Research Council did make some recommendations in terms of coal liquids.

Mr. AUCOIN. What were their recommendations?

Mr. GENTILE. Their recommendations were that direct liquefaction was a major funding recommendation. Of course, they were looking at the transportation sector.

Mr. AUCOIN. Are we doing that?

Mr. GENTILE. Direct liquefaction?

Mr. AUCOIN. Yes.

Mr. GENTILE. Yes. We're doing it at a reduced level.

Mr. AUCOIN. Describe the reduction.

Mr. GENTILE. The reduction was from the base of $17.7 million. The request is $4.5 million.

Mr. AUCOIN. Oh, that is a reduction. That is one of the recommendations that the Government go forward with that?

Mr. GENTILE. There have been major advances in direct liquefaction. We have moved from about $70 in the 1970s down to about $35 a barrel right now, so we think there have been major advances. Yes, there have been major reductions in the program basically because, again, with limited resources we had to prioritize among projects.

Mr. AUCOIN. What are some of the other recommendations of the——

CO-PROCESSING OF COAL

Mr. GENTILE. They also recommended that there be moderate funding of the coal co-processing and modest money, or the lowest priority, in indirect liquefaction.

Mr. AUCOIN. What is the budget request reflected in those two areas?

Mr. GENTILE. In indirect liquefaction, the base is $8.5 million. The request is $2.4 million. Co-processing is $1 million.

Mr. AUCOIN. Your request is $1 million?

Mr. GENTILE. Yes.

Mr. AUCOIN. And what was the base?

Mr. GENTILE. It is not a line, so we would have to supply that for you.

Mr. AUCOIN. Okay.

[The information follows:]

Co-Processing Funding Comparison

At this time coprocessing is in a developmental stage. The research includes two bench-scale process development units and several smaller scale exploratory technology base activities. In FY 1990, $1,356,000 will be spent on these activities which are budgeted to continue in FY 1991 at a funding level of $1,307,000.

INDIRECT LIQUEFACTION

Mr. AuCoin. Is it down?

Mr. Gentile. It is almost the same.

Mr. AuCoin. So you are basically treading water there, but in indirect liquefaction you've got a reduction of approximately how much?

Mr. Gentile. About 53 percent. I'm sorry, I'm looking at the wrong thing there. It is about 71 percent.

Mr. AuCoin. So you must disagree with the basic findings of the National Research Council?

Mr. Gentile. No, I don't think we disagree at all. We think that direct liquefaction has some exciting potential, especially if we can get it down to $25 to $30 a barrel. It is strictly a matter of prioritization. In the area of coal co-processing, we also have a Clean Coal project in that area, and also indirect liquefaction. We've got a major upscaling in indirect liquefaction.

Mr. AuCoin. So you do agree with the findings of the Council? Is that what you're saying?

Mr. Gentile. We agree that direct liquefaction is of particular interest. It is a matter of prioritization among all the different things that we have to look at, both within Fossil and within the Department.

Mr. AuCoin. If you agree with those findings and then you cut the funding by 71 percent, I really wouldn't want your support for anything I was presently working on. I'd rather have your opposition. How much would you plus it up if you were opposed?

LIQUEFACTION

Mr. Gentile. Mr. Chairman, this study came out really after the 1991 budget was formulated.

Mr. AuCoin. So might it be a document on which more emphasis is put when you formulate the next budget?

Mr. Gentile. Well, certainly, looking at the next budget, we'll look at the study.

Mr. AuCoin. Do you believe that viable alternatives to oil will be developed? If so, what do you think the Government's role should be, in your opinion?

Mr. Gentile. I do feel that some alternatives will be developed if the price is at the right place. We are doing several things. We are doing both in the coal liquefaction. We're doing indirect liquefaction, and we're doing coal water slurry. We're looking at several different activities.

Mr. AuCoin. Should it be Government policy to develop the domestic substitutes for foreign-supplied liquids? Is that in the public interest?

Mr. Gentile. I think that, as we go through the process this year in looking at a national energy strategy, we'll focus on that a little bit more. We are going through a quite extensive activity at the

Department right now, and I'm sure this is one of the issues we're going to be looking at quite significantly.

Mr. AuCoin. How do you feel about it going into that discussion yourself?

Mr. Gentile. I feel that we're having some problems with our offshore oil and gas production. That causes a dilemma. We would like to see us get some of these products down to where they can either compete or be on the verge of competing. Yes, there is some interest there.

Mr. AuCoin. So going into those discussions, you would be inclined to say, "yes," that would be a policy option for the——

Mr. Gentile. Oh, most definitely it is going to be considered a policy option.

NRC REPORT

Mr. AuCoin. The NRC report recommends major funding at the pilot-scale level for direct liquefaction of coal and the development of oil shale. The target here is to develop $30 per barrel substitute fuels. The budget reduces the oil shale budget to about zero and does away with 75 percent of the direct liquefaction in the budget, including all pilot-scale activity. In that respect, does this mean that you disagree with the NRC study?

Mr. Gentile. No, we don't disagree with the NRC study at all.

Mr. AuCoin. You're loving it, is that it?

Mr. Gentile. Yes, we're smothering it with love. Congressman, the report did come out just a couple of months ago, and we didn't really look at it in this budget context. We will be looking at it in FY 1992 and also, in part, for the national energy strategy.

Mr. AuCoin. Do you think the industry will make up the difference in funding in terms of the shortfall that will be in this year's budget request? I would guess not. What do you think?

Mr. Gentile. I would probably think not.

OIL SHALE PROGRAM

Mr. AuCoin. In the Oil Shale Program, no work is contemplated in fiscal year 1991, yet that is one of the highest priorities in that study that we have been discussing. Is it reasonable to assume, as the NRC study does, that prices of shale products can be reduced to the $30 a barrel level? Do you think that is reasonable?

Mr. Gentile. Yes, I think it probably is, especially in the pilot plant and demonstration. Both Amoco and Exxon have studies showing that they are in the $30 to $35 per barrel range right now.

Mr. AuCoin. Would it be possible to establish an oil shale program such as currently exists in the Coal Liquefaction area that looks at advances in technology on a research bench scale based on those areas that those familiar with the field choose? And then once technological advances are established, test those at a small pilot-scale level?

Mr. Gentile. Well, there is no question that a pilot plant is one of the best methods to evaluate the potential. We don't think that we need those pilot plants right now.

Mr. AuCoin. But on the basis of the 1991 request, we're not even doing any research, are we?

Mr. **Gentile**. On the 1991 request, we're not doing any research?

Mr. **AuCoin**. Right.

Mr. **Gentile**. No. We're just doing some work with, I think, WRI.

Mr. **AuCoin**. You're doing precious little.

Mr. **Gentile**. It is basically characterization work.

Mr. **AuCoin**. Down to $662,000 from the $9 million previous level.

Mr. **Gentile**. It is basically characterization work done at WRI.

Mr. **AuCoin**. How long would it take to set up a small pilot-scale program that I've just described?

Mr. **Gentile**. Well, we would probably need one to two years to develop the program and probably would operate it for five to ten years.

Mr. **AuCoin**. How much do you think that would cost on an annual basis?

Mr. **Gentile**. It probably would cost, using a technology like Lawrence Livermore, about $11 million a year for about 10 years.

Mr. **AuCoin**. I think you could get industrial support for that kind of an undertaking. What about you?

Mr. **Gentile**. There is commercial activity out there in terms of oil shales. We know of that commercial activity. I think that they would like to see some joint venturing in that area.

Mr. **AuCoin**. There is industry interest in doing joint venturing. Do you agree with that?

Mr. **Gentile**. I think there is some activity, particularly in situ and on the surface, where we don't really have that much demonstrated interest.

Mr. **AuCoin**. Yes. The in situ technology you are talking about is one in which Occidental Oil Shale, as we understand, has, in fact——

Mr. **Gentile**. Yes.

STATUS OF COMPREHENSIVE OIL SHALE PLAN

Mr. **AuCoin** (continuing). Requested Government support for large-scale development of an oil shale tract leased from the Government. What is the status of the comprehensive plan for which funding was provided in last year's appropriation on that?

Mr. **Gentile**. Well, their proposal was evaluated favorably, and they were accepted for negotiations and cooperative agreement. Approval was given for them to incur some costs at their risk. We are proceeding, assuming that a contract will be awarded. It is expected to be awarded in May of 1990, with a preliminary report due in June of 1990 and a final report in September of 1990.

Mr. **AuCoin**. So the plan, then, will be complete in September of 1990?

Mr. **Gentile**. The report, yes.

Mr. **AuCoin**. What is the difference between the report and the comprehensive plan?

Mr. **Gentile**. It's the same thing. A preliminary plan is what it is.

Mr. **AuCoin**. That will be completed in September of 1990?

Mr. **Gentile**. Yes.

Mr. AuCoin. On a technological basis, is the size of the facility contemplated by Occidental the next logical step in the development of this kind of technology?

Mr. Gentile. It is a full-scale retort with two retorts operating continuously. They're looking at about 17 retorts in 7 years. It is a very interesting project but, again, it is a matter of prioritization. This is a long-term project. Right now, we try to focus our resources on solving some near-term problems. Therefore, it is not one of our priorities at this time.

Mr. AuCoin. Would it make sense to use existing surface technology? Or would it be better to test new concepts in such a project?

Mr. Gentile. Well, again, we don't think that either is justified at this time in terms of priority. The development of surface technology is something that is independent of the in situ. An in situ demonstration could prove useful, and we are interested in what is going on there, yes.

Mr. AuCoin. The NRC, as one of its major recommendations for major funding, endorses production from coil and western oil shale. On that point, you were in disagreement with the NRC.

Mr. Gentile. No, no. Absolutely not. We also think that the western oil shales are of tremendous importance to this country and will, in the future, give us a great leverage. We have great hopes for the western oil shales and even for a process like the in situ retorting we are talking about.

Mr. AuCoin. What hope do you have that you'll ever fund the programs at a level that will help expedite their reality?

Mr. Gentile. We'll have to look at it again in the 1992 cycle. We, again, had to choose among priorities this year. This was not one of the priorities we selected.

Mr. AuCoin. Not one of the priorities you selected? Staff reminds me that we've seen a decline over nine years by the Department for oil shale production, and fossil energy, in general. It is hard for me to understand, then, how you would indicate that you agree with the NRC in a study on that respect.

Mr. Gentile. Again, we think the NRC study was a valid study. It looked at developing liquids. We agree with that. We agree with the western oil shales. It was just simply not a priority at that point in time. As we move through this year and look at the National Energy Strategy, we will most certainly be looking at this as one of our options.

OIL IMPLEMENTATION PLAN

Mr. AuCoin. Let's discuss the Oil Implementation Plan. Would you explain to the Committee for the record how you intend to manage and contract for the program? Let me guide you into this by asking you this question: Why is it deemed necessary to specify funding for consortia of universities and industry?

Mr. Gentile. What we're trying to do here, Congressman, is look at an overall strategy as we approach oil and gas. We have had a series of meetings. We are trying to identify what the needs are in different reservoirs. We're facing a major problem in this country in those reservoirs, but we're seeing abandonment rates and well pluggings to the point that we're very seriously concerned about that. As well as abandoning your plug, they basically block off that resource.

What we've done is taken a look at how to approach it. We have had a lot of public input, and we've come up with a plan that we will be submitting to Congress next month. We think that it is critical that, in approaching the problem, we have considerable involvement with the non-Government sectors that are dealing with this problem, particularly industry, some of the universities, and some of the States. Our approach here is to put together a program that involves all of these parties and a cost sharing method to try to attack the needs that we see.

Mr. AuCoin. Are there other types of contracting arrangements that can be made besides the approach involving consortia at universities and industry?

Mr. Gentile. We are going to be looking at several different approaches. We plan on, after submitting this product next month, concurrently looking at what our options are in terms of contracting and how to approach it. We think that the consortium is one of the best approaches, since it includes all the parties. Yes, we will be looking at different types of contracting documents.

Mr. AuCoin. Is that an idea that began with the Department? The consortia idea?

Mr. Gentile. Well, it has been a long-term idea. We have cost shared so many of our programs in Fossil that it is nothing new to us. We have cost shared with industry. We have cost shared with universities and the States. Our oil partnership with the labs and industry is an example of that. It is not a particularly novel idea.

Mr. AuCoin. It began, though, with the Department?

Mr. Gentile. The idea of this type of activity.

Mr. AuCoin. For the Oil Implementation Plan?

Mr. Gentile. The specific language was generated in the passback, but it is not something that was not contemplated in terms of our planning.

Mr. AuCoin. I don't understand "passback." What is that?

Mr. Gentile. I'm sorry. In the OMB review process.

Mr. AuCoin. OMB suggested the language?

Mr. Gentile. They suggested the exact language. However, we never contemplated doing anything other than cost sharing and being involved with industry, States, and universities.

Mr. AuCoin. Is that unusual for OMB to send back language of that sort? That sounds like a policy idea.

Mr. Gentile. I've not had the pleasure of going through the experience yet, so I don't know directly myself.

Mr. AuCoin. Why do you intend to use a major integrating contractor for each class of research?

Mr. Gentile. I'm not sure that we have made that final decision yet. We are going to be looking at that.

Mr. AuCoin. Our Committee understands that you have. Is it in the draft plan?

Mr. Gentile. It was in the draft plan, yes, but we have not made that decision at all.

Mr. AuCoin. What kinds of organizations would qualify as a major integrating contractor if the draft plan became the final plan, and that's the plan you went with?

Mr. Gentile. The draft plan has been revamped. Mike McElwrath is the Deputy Secretary. Mike, would you like to take the question?

Mr. McElwrath. Sure. I'd say that——

Mr. AuCoin. What kinds of organizations?

Mr. McElwrath. In terms of a major integrating contractor, we could be talking about a variety of groups. The word "consortia," as we use it in our plan, covers a lot of territory. Consortia can certainly serve as an integrating contractor. In that sense, this would probably be a grouping of any one or more of the following groups: universities, States, State geologists. In all cases we would want industry participation from both the production side and the service company side of the spectrum. We would look at things on both a regional and a national basis.

What we have seen in looking back over the historical evolution of our program, is that in the past the emphasis was on long-term research, which is not acceptable now when we focus more closely on the near and mid-term. We have discovered that in the past our research has not disseminated to the field as quickly as we would like.

Mr. AuCoin. This is a way to overcome that?

Mr. McElwrath. Yes, in the sense that we have now a major refocused effort on the near- and mid-term. The plan is comprehensive enough and substantial enough that we find ourselves essentially facing two challenges. One is how to manage such a comprehensive plan on a day-to-day basis from headquarters, and from our field centers for that matter.

So part of the answer is that you're looking for management on a day-to-day basis with oversight from headquarters and the field by somebody preferably extremely experienced in the industry and with substantial contacts throughout the oil and gas industry.

Fortuitously, that allows us to use groupings of people that, in managing the plan, will probably increase access to the private sector in technology transfer.

Mr. AuCoin. Let me just move to the competitive aspects of this idea. If you go with only one major contract for each class, how much real competition will there be within the program if, for each class, there is only one major contractor? It sounds to me as though that's a reduction in competition.

Mr. Gentile. Any consortium can be put together to bid on the contract, and the intent is to do it competitively. Are you saying "Is there a great mix only available in one or two situations?" I don't know if we know that. I'm not sure that we have decided to do one major contract per class.

Mr. AuCoin. Well, I'm thinking in terms of the length of time one of these programs is going to entail. If you're talking about 10 years, you're talking about a long timeframe. You're talking about a lot of money and on one contract. It would seem to me that that doesn't leave a lot of competition during that period of time when that money is being spent.

Mr. **Gentile**. We really have not made that decision, Mr. Chairman. We are looking at that right now. We have concerns about long-term contracts that don't come up for renewal and review. That is a major consideration to us.

Mr. **AuCoin**. Let me just ask you this: If a major integrated contractor approach was not used, what alternative approaches are there to be used?

Mr. **Gentile**. Well, we are going to be looking at that. Right now, there are a whole series of activities. We could go to, for example, National Labs as a manager. We believe the lab would have to subcontract, however. We want to look at those opportunities as we finalize our plan.

Mr. **AuCoin**. That's one alternative. What are some other ones?

Mr. **Gentile**. The other is to try to put together a private sector group that did not blend all the parties together. We don't think that is a good option. We'd like to see a group that has input from a series of people. The question is, however, do we need to do 1 contract for 10 or 12 years.

Mr. **AuCoin**. Why do you have to do one contract over a period of years? Why couldn't you contract——

Mr. **Gentile**. You don't have to. That's one of the things we're looking at.

Mr. **AuCoin**. Okay.

Mr. **Gentile**. I agree that that is one of the things that we have to look at.

PROGRAM DIRECTION AND MANAGEMENT SUPPORT

Mr. **AuCoin**. All right. Let me move on to program management and support. The House report on the fiscal year 1990 appropriations bill stated, in part, and I'm quoting, "The Committee directs the Department to reflect accurately the cost of Program Direction in future budgets and not inflate what can be accomplished in research programs, as has occurred in fiscal year 1990." The fiscal year 1991 budget not only reduces Program Direction drastically again, it decreases Energy Technology Center services from $30,445,000 to $4,194,000.

It also states on page 110 that, "Additional costs will be charged to R&D projects." Why do you insist on presenting the budget in this fashion, especially since the House has been very clear on what it thinks about that approach and has actually directed you, I refer you to the language in the 1990 bill. The Committee directs the Department not to handle the budget in that fashion.

Mr. **Gentile**. It was felt that charging certain overhead costs to projects would more accurately portray the costs of developing the technology. As we reduce the programs, it would be a disproportionate amount in the overhead, and we still need that program direction.

Mr. **AuCoin**. Let me ask staff to help me recollect this. We broke out the budget in a different way last time in order to avoid some of the problems. Did we break out overhead expenses?

That's right. I remember now. What our Committee did was set up a Program Direction account so that overhead other expenses would not fall over somewhere else. What you're doing is going back to the old method before this committee took that action. My question is: Why are you doing that?

Mr. **Gentile**. It was felt that——

Mr. **AuCoin**. It was felt that this Committee doesn't matter?

Mr. **Gentile**. No, sir, Mr. Chairman.

Mr. **AuCoin**. It was felt this Committee was asleep at the switch that day? This Committee was inconsequential? What was it felt?

Mr. **Gentile**. Not at all, Mr. Chairman. It was felt that as we were reducing the funds——

Mr. **AuCoin**. Was it felt that OMB was more powerful than this Committee?

Mr. **Gentile**. No, sir, Mr. Chairman, not at all.

Mr. **AuCoin**. Did OMB tell you to do that?

Mr. **Gentile**. It was requested by the Department, yes.

Mr. **AuCoin**. Really? The Department, notwithstanding what the Committee directed you to do, said, "OMB, we want to do it the other way"?

Mr. **Walsh**. No. We requested the account from OMB.

Mr. **AuCoin**. You requested a return to doing business the way——

Mr. **Walsh**. No. We requested that in the Program Direction account.

Mr. **AuCoin**. Oh, you wanted to do it the way the Committee had you do it?

Mr. **Walsh**. Yes, sir.

Mr. **AuCoin**. So you do think the Committee is consequential? OMB doesn't think the Committee is consequential. [Laughter.]

Mr. **Gentile**. I can't speak for OMB, Mr. Chairman.

Mr. **AuCoin**. How much additional cost, just for the record, do you expect to require as a minimum to operate the two Energy Technology Centers on some reasonable basis? You can provide that for the record, if you'd like.

Mr. **Gentile**. Okay.

[The information follows:]

Additional Cost Required To Operate the Two Energy Technology Centers on a Reasonable Basis

Assuming the level of support is the Congressionally mandated floors of 715, the Energy Technology Center Program Direction funds needed at a minimum by the Energy Technology Centers, Bartlesville Project Office, and Metairie to operate on some reasonable basis would be as follows:

	Amount
Salaries and benefits	$19,199,000
Travel	1,200,000
Contract services	32,000,000
	$52,399,000

Mr. **AuCoin**. We have a lot of additional questions for the record, including some of my own. We have a vote on the House floor as you can see. I will not be able to ask them. Mrs. Boggs of Louisiana has questions as well that we will supply you, as well as additional questions from the Committee. If you'd respond to those for the record, we would appreciate it.

This is your first time through this process, is that correct?

Mr. **Gentile**. At Energy, yes.

Mr. AuCoin. Where were you before that?

Mr. Gentile. I was a Director at the Office of Surface Mining in Interior.

Mr. AuCoin. Well, we welcome you, as we close, in your new capacity. We'll try to give you a budget that is robust. [Laughter.]

Mr. Gentile. Thank you, Mr. Chairman.

Mr. AuCoin. Thank you.

[Questions and answers for the record follow:]

Additional Committee Questions

Strategic Petroleum Reserve

Financing of Oil Acquisition

Question: With funds requested in the budget, how much oil can be purchased in fiscal year 1991?

Answer: We estimate that on a straight purchase basis (as distinguished from a "lease"), DOE would be able to acquire nearly 22 million barrels in FY 1991, at an average rate of 59 thousand barrels per day.

Question: Is the estimate in the budget of the amount of "excess" receipts available from the Naval Petroleum Reserves still accurate?

Answer: We have not changed our estimate of FY 1990 Naval Petroleum Reserve revenues at this time. However, the Department is aware that prices and sales volumes have declined since the budget estimates were developed. Accordingly, the estimates are being reviewed and may be updated over the coming months.

Question: What is the maximum oil fill capacity in FY 1991?

Answer: The maximum oil fill capability in FY 1991 will be 73.7 million barrels or an average 202,000 barrels per day. This is based on the planned FY 1990 fill rate of 39,000 barrels per day and filling to the maximum available capacity of 665 million barrels in FY 1991.

Question: What would the cost be to fill at that rate?

Answer: At the rate of 202,000 barrels per day and at an estimated average delivered oil cost of $19.09 per barrel (assuming straight purchase), the cost would be approximately $1.4 billion.

Question: How does that rate change in future years?

Answer: The SPR will have the capability of completing the 750 million system by the end of FY 1992 when the final 85 million barrels of storage capacity becomes available for fill. This would involve an FY 1992 average fill rate of about 233,000 barrels per day (assuming fill to the maximum capacity available in FY 1991.)

Question: From what sources are you filling the Reserve now?

Answer: The last cargo of oil from Mexico under the contract with Petroleos Mexicanos was delivered at the end of March 1990. The Defense Fuel Supply Center is currently acquiring SPR crude oil from the world spot market by way of an open continuous competitive solicitation. Oil currently under contract from the world spot market originates from the North Sea and the Middle East.

Question: What are prices compared to budget estimates?

Answer: The oil prices used in the budget are $19.09 per barrel in FY 1991 and $19.86 per barrel in FY 1992. The oil prices used in the budget for FY 1990 assume an average delivered price of $18.78. Through February 1990, the average delivered price has been $19.83.

Question: Please provide the prices assumed in the budget?

Answer: We estimate an average delivered oil cost of $18.78 per barrel in FY 1990 and $19.09 per barrel in FY 1991.

Leasing Proposal

Question: If the government reconsidered a lease once it was in place and had to purchase alternative oil, wouldn't it likely cost more than if purchased originally?

Answer: The cost of reconsidering a lease and replacing it with a purchase contract would depend on the terms of both the lease and purchase contracts and on the timing of the transactions. While it is difficult to speculate on the specifics of a lease-to-purchase reconsideration, it would be reasonable to assume that a cost would be incurred that would be higher than a direct, originally planned purchase.

Status of Procurement

Question: What is the status of the procurement for terminal services or facilities in the Beaumont/Lake Charles/Port Arthur area?

Answer: The Department's procurement for marine distribution services in Beaumont/Port Arthur/Lake Charles was cancelled in February 1990. Only one offer was received and subsequent negotiations failed to produce acceptable terms.

Question: When will you know whether the capacity must be built by the Government or whether it can be provided commercially?

Answer: No Government facilities are presently planned. The Department is currently evaluating the feasibility of resoliciting for commercial marine distribution services in late 1990. Also, there are possible SPR distribution expansion opportunities associated with recent industry initiatives in reversing and expanding Gulf Coast distribution systems into the mid-continent.

Question: What added distribution capacity is needed there?

Answer: An additional 600,000 barrels per day will be required within the Texoma complex to achieve distribution capabilities associated with the drawdown capabilities of the Big Hill storage site.

Question: What is the range of costs necessary to provide this capacity? (See page 285, 1990 hearings)

Answer: If this capacity is provided for through commercial marine distribution services, the cost is estimated to range from $30 to $60 million. Should the government elect to build new facilities, the cost could be higher.

Question: What funds previously have been appropriated and what funds are budgeted in 1991?

Answer: Congress has appropriated a total of $126.6 million for the distribution enhancement program. Approximately $7.3 million is presently available for this procurement; another $13.2 million is requested in FY 1991.

Question: What is your current schedule for achieving this capacity?

Answer: Due to the procurement cancellation, the original schedule for achieving the 4.5 million barrel per day distribution capability by 1992 may need to be extended. Achieving 4.5 million barrels of drawdown/distribution capability is also dependent on achieving substantial fill of the Big Hill site. Currently projected SPR oil fill rates are such that a delay in achieving the 4.5 million barrels per day distribution capability would not likely result in significant impact in the amount of time required to drawdown the Reserve's inventory.

Question: Can you meet it?

Answer: This depends on industry's receptiveness to the Department's solicitations for commercial marine distribution services.

Repair of West Hackberry Lines

Question: The budget indicates that repairs on the West Hackberry brine disposal line are required. Are there any other sites where you have such problems?

Answer: Bryan Mound has also experienced brine line deterioration.

Question: If so, when is the repair scheduled and how much will it cost?

Answer: Bryan Mound brine line repairs are estimated to require 24 months and to cost $5.0 million. However, the repair plan is subject to approval by the Environmental Protection Agency and by the Texas Water Commission. Meetings with these agencies to consider the plan are scheduled for early April 1990. Repairs will be initiated upon receiving these approvals.

Capital Improvements

Question: Provide a list of capital improvement projects for FY 1990, and those anticipated in FY 1991.

Answer: The capital improvement projects for FY 1990 are:

- Lightning protection at Weeks Island and St. James
- Security perimeter detection at Weeks Island and St. James
- Cantilevered vehicle barriers at five sites
- Upgrade emergency generators at five sites
- Service shaft and fill hole security at Weeks Island
- Upgrade mine bulkheads at Weeks Island

The capital improvement projects anticipated for FY 1991 are:

- Lightning protection at three sites
- Security perimeter detection at Bryan Mound
- Fill hole pump modifications at Weeks Island
- Additional bulkhead upgrades at Weeks Island

Security

Question: At the end of 1988, DOE received authority to have protective forces personnel carry firearms. What capital improvements have been made to enhance security?

Answer: SPR protective forces have been carrying firearms since 1979. As such, the guards could only make citizens arrests. In October 1988 the President signed Public Law 100-531 which granted arrest authority for SPR protective force personnel, and made trespassing on SPR property a Federal offense. A Notice of Rulemaking required to create the trespassing offense and arrest authority guidelines prescribed by the Secretary of Energy are currently being reviewed by the Department of Justice. The Notice of Rulemaking is expected to be published in the Federal Register about June 1990. Full implementation of the legislation is expected by late 1990.

Question: What capital improvements have been made to enhance security? Are all security measures complete? If not, when will they be complete?

Answer: Since 1983, SPR security measures have been continuously and gradually enhanced, commensurate with each site's state of development. Security enhancements will continue through FY 1995. To date, security measures that have been completed include:

-- Fencing and hardening of critical areas and equipment
-- Entrance barriers
-- Alarmed doors and gates
-- Guard booths
-- Upgraded lock and key systems

The following security measures are planned for completion in FY 1990:

-- Perimeter detection at Weeks Island and St. James
-- Cantilivered vehicle barriers at five sites
-- Service shaft and fill hole security at Weeks Island

Security enhancement projects planned for FY 1991 through 1995 include perimeter detection at three sites and closed-circuit TV perimeter assessment capability at five sites.

General

Question: Please provide for the record a list of major contracts, including GSA, Defense Fuel Supply Center, National Labs, and others, comparing FY 1990 to 1991 and explaining the differences.

Answer:

Name	1990	1991
	($000s)	
Boeing Petroleum Services	119,010	119,279
GSA - power	9,011	8,859
GSA-FTS	624	866
Sandia	1,894	1,916
Fluor Daniel	7,516	5,569
Jacobs Engineering	476	831
Walk Haydel	600	0
Elmwood	506	1,155
SMS	1,320	0
Tucker Associates	4,150	5,427
Petroleos Mexicanos	71,421	0
DFSC	237,256	340,426

The contracts for ongoing program operations such as Boeing Petroleum Services, GSA for power and FTS, and Sandia for geotechnical analyses, reflect the full estimated cost of planned work. The Elmwood contract, which is for leased space in New Orleans, had an uncosted balance carried over from FY 1989 that resulted in a requirement for FY 1990 obligation of less than a full year's cost. Tucker Associates is the successor contractor to SMS and is phasing in during FY 1990.

The FY 1991 increase is therefore offset by the completion of the SMS contract. The contract with Petroleos Mexicanos reflects the completion of that contract and the increase in DFSC reflects their expanded role as the SPR's oil purchasing agent.

Question: Your annual report (p. 41) contemplates a list of prospective offerors for Reserve sales. Is such a list complete?

Answer: The list of prospective offerors currently contains 137 entries. Additional offerors may be added upon their request. However, eligibility to bid is not limited to the offerors on this list. The purpose of this list is to facilitate notifying potentially interested bidders about SPR oil sales.

Question: How is it compiled?

Answer: The list has evolved through industry expressions of interest to be included.

Question: Do you have a list of unacceptable offerors?

Answer: There is no list of unacceptable offerors; however, no one on DOE's or the Federal Government's list of debarred, ineligible, or suspended bidders can be awarded a contract to purchase SPR oil.

Naval Petroleum Reserves

"Lease" of the Naval Petroleum Reserves

Question: What indications do you have that anyone would be willing to lease the Reserves with a bonus of $1.6 billion and continuing royalties?

Answer: The Department has not polled the private sector regarding their interest in leasing the Naval Petroleum Reserves, but Elk Hills is an attractive oil field and we expect a great deal of interest, once Congress demonstrates interest in the Administration proposal and indicates that there are prospects that the oil fields may be leased.

Question: On what assumptions do you base your figures?

Answer: The Department's assumptions are in line with the SPR Financing Study Chapter VIII. The Low Price Case from the report was used with a 13% discount rate (about 10% plus inflation) and current Federal and State tax rates. The figures assume no local property tax except to lessee capital improvements. These assumptions are closer to the FY 1991 budget assumptions.

Question: Is there a financial analysis of the proposal available?

Answer: DOE has not written up the specifics of the FY 1991 Budget Case. Chapter VIII of the SPR Financing Study explains the logic, and the basic data are compatible.

Question: Page 197 of the budget justification suggests that leasing would be consistent with the development of other government resources. Are not these other lease programs done on undeveloped and more speculative properties?

Answer: Yes, most Federal leases are for undeveloped properties. The geological risks are higher for undeveloped properties, but, for NPR leasing, the U.S. Government will seek a very large up-front bonus. Therefore, there will be financial risks for the lessee(s). Additionally, leasing these fully developed fields through a competitive bidding process would allow the Government to capture the benefits of differences in professional opinion on the potential production of the fields and the future price path of oil. It would also assure that decisions on running the fields are made by parties with incentives to make the most of these properties. These advantages of leasing apply to both developed as well as undeveloped fields. Because the United States Government has only a few oil properties that it operates, management expertise is thin, and leasing the developed fields is as sensible as leasing unexplored property.

Question: Doesn't the private sector take major risks in attempting to develop these resources?

Answer: The risks associated with Naval Petroleum Reserves No. 1 and No. 3 are low for the proved producing reserves. The lessees would not have the uncertainty associated with construction costs, permitting, environmental regulations or sales, because all of these issues have already been addressed by the Government during development of the fields. The risks faced by the lessees would be oil and gas price uncertainty, exploratory uncertainties, new technology uncertainties, and cost uncertainties for any new facility construction. Also, as noted above, risk sharing is only one of several reasons the Governmemt leases properties. The Government would also seek to capture economic rents and to have decisions made by parties with direct economic interests in the properties.

Question: Isn't this why we accept royalties and up-front bonus payments in lieu of the full value of the resources?

Answer: Bonus/royalty payments are intended to reflect the full value of the resources after accounting for risk. For Elk Hills, we are seeking a high bonus payment to account for lower geological risk. The Government also leases properties to take maximum advantage of the incentives leasing creates to run the oil fields in a business-like way and to capture economic rents. All three of these rationales are relevant to the NPR leasing decision. Admittedly, the risk at Naval Petroleum Reserves No. 1 and No. 3 is less than in undeveloped areas, but the Government will be compensated for the lower risk, and the lease makes good sense for the other reasons.

Question: What do we gain by leasing rather than producing the Reserves ourselves?

Answer: By leasing rather than producing the Reserves ourselves, we gain up front cash payments, royalties reflecting trends in production and prices, and Federal income taxes from the new operator. Leasing removes the U.S. Government from competing in the oil business and can finance for the Department of Defense a readily usable Defense Petroleum Inventory (DPI). Leasing also allows us to refocus DOE resources on other energy initiatives and the Reserve will benefit from potential efficiencies from private operation.

Question: Is it not correct that no one will make a lease bid unless they assume that they will make a substantial return on their $1.6 billion investment?

Answer: Yes, we assume that lessees would want to make a return on their investment.

Question: Why should that return go to the private sector instead of the government?

Answer: The Government owns and produces the Naval Petroleum Reserves because of determinations made approximately 70 years ago that the military required reserves of oil for use in emergencies. Since 1976, the Reserves have been produced for other purposes, but always with the idea that these were military reserves. However, after 14 years of production at the maximum efficient rates, neither Naval Petroleum Reserve No. 1 nor No. 3 is capable of providing the incremental production that the armed forces might need in the event of a disruption of supplies without disrupting the civilian economy now dependent upon these supplies of oil. The Administration is proposing to substitute the Defense Petroleum Inventory for the role currently being played by the Naval Petroleum Reserves, a role that is fully within the purview of the Government.

In addition, while it is impossible to quantify, we believe that additional cash flow could be generated from these Reserves by a reduction of costs and an increase in production efficiencies if the Reserves were managed by private entrepreneurs. It is this expectation of efficiencies generated by new management which causes private companies to divest themselves of assets and whole subsidiaries, and other companies to purchase those same assets. There is a growing consensus, especially in light of events in eastern Europe, that private enterprises are better than governments at running commercial businesses. In a similar fashion, the Administration believes that it should concentrate on matters properly of concern to the Government, and that day-to-day decisions on oil field operations are properly the concern of the private sector.

Question: Aren't the reserves of oil remaining well enough defined so that a bidder would have much more assurance of profit than he or she would in normal government leasing situations?

Answer: Not necessarily. The big up-front bonus payment creates a financial risk for the lessee. Royalty payments are "off-the-top" of revenues, so the lessee bears all of the risk of operating costs. In any event, the lease would be allocated competitively, going to the highest bidders. It would be finalized only after the Department of Justice certified the lease would not violate any anti-trust statutes. Therefore, the Government is assured of getting as much value as possible from leasing these assets.

Question: If so, aren't we almost assuring a profit for someone else that normally would go to the government?

Answer: No, the lessee may have very low production risks based on proved producing reserves, but the financial risk associated with price changes and the uncertainties of marginal activities such as drilling, exploration, and facilities development create a real risk that the lessee may not get a rate of return on investment that would be comparable to the rate of return from other investments. In addition, it is important that we will be creating incentives that do not now exist, or exist only in diluted form, to run the oil fields on as business-like a basis as possible.

Question: Why should we do that?

Answer: We wnat to maximize the value of the fields, and to focus limited Government resources on functions that are clearly governmental.

The Naval Petroleum Reserves should be treated the same as any other oil fields, and the Government should avoid competing with the private sector simply because these assets were developed while in the Government's possession.

Question: Page 197 of the budget justifications states that leasing will allow the government to retain ownership of these assets. To what advantage?

Answer: The U.S. Government would share in out-year value from price and production shifts and has some oversight over land use and environmental compliance. The U.S. Government would also get the residual value of real property and the probability of exemption from local real property taxes. The advantages would be similar to those the Government gets from leasing rather than selling other properties.

Question: Page 200 of the budget justifications states "leasing the rights to produce oil and gas there allows the Federal Government to focus limited time, attention, and other resources on governmental rather than commercial activities." On page 201 the justifications then states, "Few if any staff reductions are anticipated because manpower would still be needed to monitor production and environmental activities, verify payments and manage the program." Which statement is correct.

Answer: Once we implement leasing, there will be a change in the character and level of Federal involvement. The pace and degree of change cannot yet be predicted precisely. The statement on page 200 refers to the fact that there will be less need for top-level involvement, including in the annual budget process. The statement on page 201 refers to the fact that we have no plans for immediate staff reductions or other actions until the staffing requirements for lease administration are clearer.

Question: In effect, won't you be using the same amount of people, as you say, while returning less profit to the Treasury for other purposes?

Answer: Initially, the Department will utilize manpower billets, no longer needed in the field due to the lease, for NPR related activities at headquarters. Over time, these manpower resources will be dedicated to other activities within the Department. However, it should be clear that the salaries and overhead associated with Government employees working on the Naval Petroleum Reserves are only a small fraction of the roughly $200 million budget for this program.

Question: Please explain the timing of each of the steps necessary to lease the Reserves and to assure the bonus payment of $1 billion by September 1991.

Answer: In order to lease the Reserves by September 1991, all of the parties involved must act cooperatively and quickly. The following activities must take place in sequential order although much work can proceed concurrently:

Passage of authorizing legislation
Negotiation of an amended Unit Plan Contract with Chevron
Issuance of lease solicitation
Bid evaluation
Negotiation
Antitrust review
Secretarial Determination of Fair Market Value
Award of Lease

In order to lease by September 1991, we estimate that the issuance of the lease solicitation must occur no later than April 1991, to allow the Departments of Justice and Energy the time needed for analysis and negotiation with the potential lessee. In preparation for that event, the Department will need an amended Unit Plan Contract for Naval Petroleum Reserve No. 1 in February 1991, and given the complexity of that document, negotiations with Chevron should begin no later than September 1990, although an earlier start would greatly increase the potential for a timely lease. The schedule assumed in the budget is ambitious but feasible if Congress decides to support this market-based initiative.

Question: Previous proposals would have allowed multiple owners and protection for small refiners. What would the present proposal do?

Answer: The Department has not committed itself to a specific lease solicitation form at this time. We do anticipate that having multiple lessees could mitigate antitrust problems, and allow independent refiners to compete for leases, thereby assuring themselves of supply. We also found during our marketing study that for purposes of divestiture, having multiple participants would allow us to add value to the sale, and we believe that the same situation might apply to the lease. Therefore, at the appropriate time, we intend to look into the feasibility of a lease mechanism which would allow multiple lessees.

The legislation the Administration is preparing to propose to the Congress, which would authorize leasing the Naval Petroleum Reserves, will provide that the Department of Justice review the proposed leases under the antitrust statutes. If the Attorney General should find that a lease would either create or maintain a situation inconsistent with the antitrust laws and if a potential antitrust violation is identified, the Government will not enter into the lease. This provision will provide protection for small and independent refiners who are not able to successfully compete for the Elk Hills leases.

Question: Previous legislation would have allowed foreign buyers. Will this legislation allow foreign lessees?

Answer: We intend to apply the same rules to the Naval Petroleum Reserves that the Department of the Interior applies in leasing other oil and gas properties. Those rules are essentially based on reciprocity; they allow foreign nationals to invest in the United States if the host country of the foreign national allow United States investments in the host country. Excluding foreign investment in the Naval Petroleum Reserves would, of course, reduce the amount of money the Federal Government could realize from leasing these assets.

Defense Petroleum Inventory

Question: Does the Department of Defense believe that the Defense Petroleum Inventory is essential?

Answer: DOD believes the Defense Petroleum Inventory is very important if Elk Hills is not under the current level of U.S. Government control. The Defense Petroleum Inventory would cover DOD needs prior to a severe supply disruption which could trigger SPR use, or exercise of the Defense Production Act. With Elk Hills under U.S. Government control, DOD resources are oriented toward maintenance of refined product stocks rather than crude oil.

Question: If so, why would they not request a direct appropriation?

Answer: The Department of Defense (DOD) is supportive of the Defense Petroleum Inventory (DPI) to replace the Naval Petroleum Reserves (NPR). DOD views the DPI as an asset exchange for giving up its direct access to the production from the NPR.

Question: Why couldn't it also be earmarked from current NPR revenues?

Answer: Earmarking current NPR revenues for DPI use would not address the overall U.S. deficit situation. The DPI is not necessary while Elk Hills remains under U.S. Government control.

Question: Who would pay for the maintenance of the Reserve?

Answer: Routine Operations and Maintenance costs which will be small, would be borne by the Department of Energy. Incremental Operations and Maintenance costs associated with any drawdown would be paid by D.O.D. The Department of Defense would pay for oil replenishment after use.

Question: What are the costs associated with this proposal?

Answer: The incremental 10 million barrels in storage capacity is expected to cost $40 million, spread equally between FY 1992 and FY 1993. The oil acquisition cost is about $214 million under current projections, $50 million per year from FY 1992-95 and $14 million in FY 1996.

Question: How many barrels per day could be removed from the dedicated inventory?

Answer: When stored in a single cavern, the maximum drawdown rate for the DPI is 150,000 barrels per day. A drawdown rate of 100,000 barrels per day is considered a good average rate.

Question: Where would such facilities be?

Answer: The DPI will be commingled with other SPR crude oil storage. A 10 million barrel cavern would be developed to accommodate the additional DPI inventory which will probably be located at the Big Hill site, but alternatives will be considered.

NPR-1 (Elk Hills, California)

Question: Page 198 of the Budget Justifications refers to the need for new production facilities including a gas processing plant and a gas isomerization plant. Explain the need for each, and how much each would cost.

Answer: The gas operations expansion project (GOEP) is required to avoid reduced production of crude oil, natural gas, and natural gas liquid due to gas handling and processing constraints and to improve margin of safety to operate existing facilities at levels to achieve MER. The cost of the project is $81.6 million for the gas plant and related facilities with a payback in 1.3 years. The net present value is $503 million.

The gas isomerization plant converts normal butane to more sought after iso-butane, which is an environmentally advantageous component of modern gasoline. The cost of the project is $10.9 million with a payback in 9 months. The net present value is $80 million.

Question: Do you consider the exploratory program for Elk Hills to be an aggressive exploratory program?

Answer: The exploratory program is being executed in a prudent manner. The objective is to explore deeper geologic formations, with expectations of discovering and developing new hydrocarbon reserves. Four wells have been drilled to date and testing has been conducted in several zones. Testing and related analyses will be completed in 1991. Future exploratory or development initiatives will depend on the results of those tests and analyses. To date, potential exists for gas production, but no oil.

Question: What prospects are there for additional resources? What is being done to discover each?

Answer: There are now a number of attractive prospects identified as the result of the NPR-1 exploratory drilling program. The Oceanic Sand was found in drilling exploratory Well 934-29R. Eocene Point of Rocks sandstone was found on the east end of Elk Hills and Carneros/Agua Zone was identified on both the Northwest Stevens and 29R Structures.

Actions planned include redrill and test of Well 934-29R to evaluate Oceanic sand. Carneros/Augua currently being evaluated in Well 514-30R

(29R Structure). There are no present plans to test Eocene point of rocks sandstone. The ongoing test programs for each potential zone in the current exploratory wells will identify additional potential targets.

Question: Are there additional opportunities for drilling wells currently? If so, describe them and their costs.

Answer: No. Testing should be completed and results evaluated before proceeding on future exploratory drilling.

Question: Do you plan to issue an overall report on the exploratory program?

Answer: No overall report will be issued. Results of exploratory drilling are reported in our Annual Report published pursuant to P.L. 94-258.

Question: What is the status of enhanced oil recovery (EOR) projects on Elk Hills?

Answer: Light Oil Steamflood (LOSF) Pilot Project is ongoing. Limited expansion to include key out-of-pattern areas is planned for FY 91. LOSF project has had technical success, but economics remain unproven. Continued steamflooding with proper surveillance will lead to better understanding of process behavior.

Question: Are you studying additional EOR opportunities? If so, explain them.

Answer: Yes. DOE is planning detailed laboratory studies to investigate the feasibility of polymer flooding and Alkaline-Surfactant Polymer process. EOR screening of Stevens Zone reservoirs indicated little opportunity, outside of Carbon Dioxide flooding, at this mid-point stage of development and depletion. Field project by ARCO in neighboring North Coles Levee Field failed to produce EOR oil at a commercial rate. ARCO subsequently terminated project.

Question: When would it be reasonable to expect additional EOR projects to be undertaken?

Answer: After adequate laboratory and engineering work is completed, it is anticipated that future EOR projects will be identified. Such projects may be well into the future, however.

Question: A December 1989 GAO report states that the updated reserve estimates for NPR-1 were not substantially better than previous values (page 3.) Do you agree with that assessment?

Answer: No. We believe the GAO report refers to estimates used for divestiture. Our recent study was directed towards operational applications, assuming the Naval Petroleum Reserves would continue to be run by the Government and are not leased to private industry.

The Reserve Study fulfilled its objectives by providing:

- --Independent, point-in-time "snapshot" of the hydrocarbon recovery potential of NPR-1;
- --First estimate of remaining hydrocarbon reserves in NPR-1 reservoirs according to accepted Society of Petroleum Engineers (SPE) conventions; specifically, proved reserves (both "developed and undeveloped") and unproved reserves (both "probable" and "possible");
- --Recommendations for specific activities to optimize operation and development of NPR-1;
- --Independent assessment and prioritization of requirements for future reservoir engineering work needed to increase hydrocarbon recovery and overall profitability.

The Study was the first to quantify enormous natural gas reserves at NPR-1 and provided logical framework for geological and engineering efforts to optimize depletion plans for NPR-1 reservoirs.

Question: GAO states that additional studies are required. Do you agree?

Answer: Yes. As is common in the petroleum industry, analyses are conducted for all reservoirs on an ongoing basis by on-site engineers and scientists; these are for the continual refinement of depletion strategies to achieve production at maximum efficient rates. Additionally, several focused reservoir studies are being conducted as follows:

Eastern Upper Main Body B Reservoir Study
Western Upper Main Body B Reservoir Study
Lower Main Body B Reservoir Study
Western 31S Sands Reservoir Study
N/A Shales Reservoir Study
EOR Reservoir Study
24Z Sands Simulation Study
SS-1 Sands Steamflood Tracer Study
Light Oil Steamflood Thermal Simulation Study
Carneros Reservoir Migration Study
Shallow Oil Zone ASP Laboratory Analyses
Shallow Oil Zone Equity Redetermination

GAO's statement related to recommendations made by the Contractor for additional studies. Realizing the limited scope of the initial operation reservoir, DOE specifically tasked the Contractor with developing the list of recommended areas for additional study, referred to by GAO. The purpose of this list was to obtain an independent view of those areas needing further study. Presented in priority order, this was a useful management tool with which to gauge the ongoing and planned studies at NPR-1. Indeed, most of the studies recommended by the contractor were in some stage of activity. Further, several studies of reservoirs within the 31S Structure and Shallow Oil Zone were initiated and/or modified in scope based on the Contractor's recommendations.

Question: What studies are you funding and for how much?

Answer: Specific studies now being conducted are:
- --Eastern Upper Main Body B Reservoir Study
- --Western Upper Main Body B Reservoir Study
- --Lower Main Body B Reservoir Study
- --Western 31S Sands Reservoir Study
- --N/A Shales Reservoir Study
- --EOR Reservoir Study
- --24Z Sands Simulation Study
- --SS-1 Sands Steamflood Tracer Study
- --Light Oil Steamflood Thermal Simulation Study
- --Carneros Reservoir Migration Study
- --Shallow Oil Zone ASP Laboratory Analyses
- --Shallow Oil Zone Equity Redetermination

These studies cost $13.3 million.

Question: When will the studies be complete?

Answer: Most are ongoing analyses of reservoir performance and will continue in order to continually optimize reservoir depletion. Some do have finite endpoints and will be completed in FY 1990 and FY 1991.

Question: Where do the costs appear in the budget?

Answer: Studies are funded from the Operations and Maintenance account.

Question: What is the significance of moving fluids between producing areas? (page 4)

Answer: The significance relates to the fact that communication paths exist between reservoirs within the 31S Structure and should be considered in depletion strategies for reservoirs.

Question: Page 199 of the budget refers to the possibility of developing the reservoir on closer well spacing. Has this been studied?

Answer: Yes. Infill drilling at NPR-1 has been reviewed by consultants, and is the subject of continuing study by engineering staff. Eight infill wells were drilled in the last 2 years in the east end of Main Body B reservoir to investigate effects of redevelopment from 20-acre spacing to 10-acre spacing. Additional infill wells will be drilled as economics support them. However, there are no plans to "blanket" the field or any reservoir with infill wells.

Question: What advantages and disadvantages does this present?

Answer: The advantages include accelerated recovery (time value of money), more complete geologic and reservoir definition (EOR screen), and more efficient recovery (improved ultimate recovery). The disadvantages include increase overhead (personnel), accelerated investment, and increased gas (and water) production (maintenance costs).

NPR-3 (Teapot Dome, Wyoming)

Question: Page 200 of the budget states that due to funding constraints, only 5 Shannon infill wells are planned for FY 1991. What funding constraints?

Answer: During development of the FY 1991 budget, NPR-3 was allocated financial resources of $18.4 million to fund FY 1991 operations. After prioritizing and funding the highest rated activities, sufficient funds remained to drill only 5 Shannon/Shale development wells. Had additional funds been available, and the economics more favorable, a drilling program of approximately 30 wells would have been proposed.

Question: How many wells would be economical to drill?

Answer: At the current price of approximately $18 per barrel, 131 development wells would be economical. Higher prices would result in additional wells becoming economical. However, the Office of Naval Petroleum and Oil Shale Reserves has imposed upon itself the requirement that Naval Petroleum Reserve No. 3 must maintain a positive cash flow within every fiscal year. This implies 100 percent self financing for all projects whether operations and maintenance, drilling, or development facilities. This is a conservative management philosophy, which assures the generation of cash, but at times limits drilling and construction plans to the extent of internally generated funds.

Question: Provide calculations on the economics for the record.

Answer: At current oil prices, approximately 131 wells could be economically drilled; however, these wells should be in increments of 30-40 per year, so that the results of one drilling program could be analyzed when selecting locations for the next drilling program.

For example, an FY 1991 28-well Shale/Shannon drilling program consisting of 8 Shale producers and 20 Shannon producers would yield the following economics over a 5-year productive life:

Capital Costs	$1,605,089
O&M Costs	215,672
Production (bbls)	259,376
Gross Revenues	4,820,291
Net Cash Flow	2,999,530
Net Present Value @ 10%)	2,344,820

However, because NPR-3 if investing in steam generators for its enhanced oil recovery project in the Shannon zone during FY 1991, as explained above, the expected FY 1991 cash flow cannot support an aggressive drilling program at the same time. As the steam flood increases production and revenues, and net cash flow improves, the management of Naval Petroleum Reserve No. 3 will have latitude to pursue other economically attractive methods of production.

Question: What is lost by limiting the number of wells?

Answer: Limiting the number of wells does not result in lost production, it simply defers production and revenues until such time as the wells are drilled.

Question: Please explain the EOR pilot study being proposed in conjunction with fossil energy research and development. (page 200)

Answer: The proposed study is to field test a high risk EOR technique whose potential for success in this type of reservoir rock has been proven only in the laboratory. This process is called Alkaline Surfactant Polyment (ASP) and is a nuance on a similar technique of chemical injection currently being tested in heavy oil EOR.

Question: How much funding is included for it?

Answer: Funding of $1.016 million, including some operation and maintenance activity, is requested in the FY 1991 budget for the ASP EOR pilot study.

Question: Is there also funding in fossil R&D? (If so, how much?)

Answer: $300 million has been planned for application of a similar technique in heavy oil reservoirs. The ASP application in question is for light oil reservoirs.

Question: How long will it take to run this study?

Answer: It is expected to take 1 to 2 years of additional laboratory design work and 3 years of chemical injection, with peak oil production expected in the 2nd year.

Question: Please describe the status of the steam drive development process. (page 200) Specify the various costs included on page 210 for this item.

Answer: Two steam generators are currently operational, with corresponding injection and production systems. Steam generator No. 3 has been purchased. Installation is planned for FY 1990 and currently awaiting approval of an Environmental Assessment. In addition, steam generator #4 is planned to be purchased in FY 1990. In FY 1991, steam generator #4 will be installed and steam genrator #5 will be purchased. Current production from the steam drive project is averaging 845 barrels of oil per day, approximately 35% of total field production. This figure is expected to increase as more generators are brought on-line.

Question: How much production is anticipated from this development in each year from its inception?

Answer: The Shannon Steamflood Pilot Project was initiated in 1985.

Cumulative production through August 1989: 280,818 barrels

CY 85: 9,902 barrels
CY 86: 33,147
CY 87: 65,244
CY 88: 80,398
CY 89: 92,127 through August 1989

Question: What previous work has been done with this technique?

Answer: The literature shows that about 30 light oil steamflood projects have been conducted worldwide with fewer than 5 such projects currently on line and none of the projects have moved out of the pilot stage.

At NPR-3, not only has the project moved out of the pilot phase, it is now fully economic, with return on investment resulting in full scale expansion. Up to 6 steam generators are now planned. Project status described above.

Question: Page 240 shows $2,170,000 in prior year expenses. Please explain this amount.

Answer: The $2.17 million is unspent carryover available from previous years for various projects which were cancelled, curtailed, or deferred because of marginal economics caused by the downturn in oil prices. This money was, therefore, available for the Alkaline Surfactant Polymer project for reservoir characterization and ASP screening work.

GENERAL

Question: Page 223 of the budget refers to the invocation of a rule in Kern County, California which would require modifying engines used on NPR-1. Was the rule invoked?

Answer: Yes. Kern County Rule 427, "Emissions from Stationary Internal Combustion Engines," was adopted in June 1988 setting standards for emission of oxides of nitrogen (NOx) from internal combustion engines. The Rule set emission standards for various engine sizes, and mandated reductions of 80% of NOx emissions from December 31, 1987 levels. When instituted, the emission reductions did not apply to western Kern County, where NPR-1 is located, but included a "trigger" mechanism. Mandatory emission reductions would become effective only upon a finding that four or more separate validated exceedances of the ozone National Ambient Air Quality Standard (NAAQS) of 0.12 ppm had occurred in western Kern County by December 31, 1990. In July 1989, the California Air Resource Board notified Kern County Air Pollution Control District (KCAPCD) that five exceedances had occurred, "triggering" Rule 427 for western Kern County. The rule will require the following modifications:

- By July 18, 1990, engines greater than 200 horsepower (hp) must achieve an 80% NOx reduction or emissions totalling 90 ppm on a dry basis, corrected to 15% exhaust oxygen.
- By December 31, 1995, engines greater than 50 hp must meet the above standard.

Question: What are the consequences on operations?

Answer: The impact to operations will be mandatory emission reductions from internal combustion engines utilized to power gas compressors. Initial requirements of the 427 Rule apply to 42 engines which account for almost 90,000 hp operating at NPR-1. Fortunately, much of the effort of a previous $20 million NOx Reduction Project completed in FY 1989 was in anticipation of this ruling. In this project, 34 NPR-1 engines were modified, and emissions from the 15 largest compressor engines were cut to levels which fully comply with Rule 427 through the use of pre-combustion chamber (PCC) technology. This project also modified 19 Waukesha engines with pre-stratified charge (PSC) technology; however, additional controls (catalytic converters, nozzle ring modifications, and turbochargers) will be needed to comply with Rule 427. The second phase of these reductions will require modifications to 167 existing engines between 50 hp and 200 hp. This effort will include use of control technologies, and replacement with electric engines where necessary.

Through effective planning of the initial NOx Reduction Project completed in FY 1989 to meet anticipated Rule 427 requirements, NPR-1 was able to minimize impacts to operations. Activities to achieve compliance with Rule 427 have had no negative effect on MER production.

With regard to future consequences, it should be noted that:

- Kern County, where NPR-1 is located, is a non-attainment area (does not meet standards) for National Ambient Air Quality Standards (NAAQS) for ozone and particulate matter.

- The State Implementation Plan submitted to EPA by the Kern County Air Pollution Control District (KCAPCD) which demonstrates how Kern County will come into attainment with the NAAQS, has been formally disapproved by EPA. As a result of this action, a potential exists for future regulatory requirements which may mandate additional emission reductions.

Question: Is the funding allowance in FY 1991 adequate to cover your needs?

Answer: The funding allowance reflected in the FY 1991 request will allow for continuing current activities for production of hydrocarbons at maximum efficient rates. It also provides adequate resources for satisfying known safety and environmental compliance requirements.

Question: Please provide for the record for each of the Naval Petroleum and Oil Shale Reserves, for each of FY 1989, FY 1990, and FY 1991, a delineation of the sources and amounts of revenue.

Answer: Table 1 provides total revenue information as requested by reserve, by products, and for FY 1989, FY 1990, and FY 1991.

Table 1

Revenue ($000's)

NPR-1 & NPR-2	Actual FY 1989	Est* FY 1990	Est* FY 1991
Crude Oil	441,898	414,764	394,192
Natural Gas	89,277	89,343	96,004
Natural Gas Liquids	58,090	64,494	68,648
Royalties (NPR-2)	1,781	872	885
Chevron/Other Reimbursement	24,280	40,454	40,000
Sub Total	615,327	609,927	599,729
NPR 3			
Crude Oil	14,921	16,030	17,103
Natural Gas Liquids	1,171	634	634
Other	4	0	0
Sub Total	16,096	16,664	17,637
NOSRS			
Natural Gas	144	2,957	2,095
NPOSR Total Revenue	631,567	629,547	619,561

Naval Oil Shale Reserves

Question: What is the status of the gas protection plan funded to date.

Answer: Using FY 1985 appropriated funds and FY 1989 reprogrammed funds, a total of 19 wells are on production described as follows:

One 100% DOE Mesaverde (deep), eight 100% DOE Wasatch, one DOE-operated communitized Mesaverde and nine industry-operated communitized Wasatch. Four wells are planned for drilling in FY 1990. Thereafter, all approved funding will have been expended. No DOE dry holes have been encountered.

Question: What are your projections of production and revenue by year for that part of the plan?

Answer: The following are the most recently updated production and revenue projections for the implemented part of the plan for FY 1991 - 1995:

	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995
Production (MMCF)	1,880	1,755	1,673	1,596	1,522
Revenue ($000)	3.084	3.141	3.296	3.271	3.223

Note: This assumes 14 DOE operated wells and 9 non-DOE operated wells for a total of 23 wells.

Question: Does this differ from the budget estimate? If so, why?

Answer: Yes, the budget estimate (as shown in Table 1 in response to a previous question) assumed operation of 18 wells, startup of the 8-100% DOE Parachute Field wells estimated at much later date, a different gas price scenario and the production estimates have been refined some since March 1989.

Question: Why does the budget show a decrease in production in 1991? (p. 213)

Answer: The decrease in production in 1991 will be due to the normal decline of the producing wells and because no FY 1991 funding is available for drilling new wells. Therefore, the normally decreasing gas production is not replaced by production from new wells.

Question: What revenues would be realized over what years if your pending reprogramming were approved?

Answer: The DOE portion of the revenue from participation in wells utilizing reprogrammed funds is $0.6 million during the year drilled. Revenues are expected to be approximately $1.1 million per year in years 2 through 6. There is expected to be a gradual downward trend to $0.9 million in year 19. The revenue stream assumes a starting gas price of $1.20/MCF with moderate annual increases.

Question: What is the estimated future potential for development in the oil shale reserve and surrounding area?

Answer: The potential for development both in Naval Oil Shale Reserves Nos. 1 and 3 and the surrounding area appears significant. South of NOSR-3 there are already three actively developing fields abutting the reserve boundary. These three fields may merge into one much larger field somewhere within the reserve. Drilling in these three fields has increased yearly. In 1990 over 100 wells are planned by private operators in these fields. To the north of NOSR-1 another field has been expanding progressively closer with each passing year and now its drilling is only a few miles away. Exploratory wells drilling three miles west of NOSR-1 are targeting the main producing horizons. Within three years this area will probably expand into yet another field abutting NOSR property. The BLM leases offered in this area have tripled or quadrupled in value over the past two years, an indicator that the minerals are of increasing interest to private industry. The potential for gas reserves within the oil shale reserves is unquestionably as good if not better than those outside. This is supported by the private industry drilling patterns. Each field has been initially discovered quite some distance from the reserve, but has expanded toward the reserve boundaries during development of the field without expanding in the opposite direction.

Question: Are there sufficient markets for the gas?

Answer: Gas marketing can be largely dependent on the marketing approach and the availability of transportation. Future transportation should not be a problem because of the recent construction activity improving gas transportation lines in the area as well as the building of new lines and plans for even larger capacity interstate lines within the next few years. One operator in this area has a dozen markets for gas from its wells, including several municipalities, a local oil shale refinery, several larger utilities and other smaller end users. Its marketing approach has proven very successful for two main reasons--it has sought often unconventional markets for its gas and is able to provide long-term assurance of deliverability by having in excess of 60 wells to supply the needed gas quantities. With increasing gas demand, potential markets for gas should become more attractive and more readily accessible.

Question: To what specific markets is DOE selling and planning to sell its gas?

Answer: Presently, gas is being sold to Bonneville Fuels Corporation and Western Gas Processors, primarily for use in Colorado. This gas was competitively marketed using the Invitation for Bids (IFB) process. Future gas sales will also be sold using competitive bidding. Some other initiatives are 1) to transport some NOSR gas to NPR-3 for use as fuel in the steamflood project, and 2) selling gas to the Department of Defense for fuel at military bases. The trend in Western Colorado and the surrounding area is toward construction of additional pipelines to connect with pipelines supplying the Southern California market. This will expand the marketability of the Colorado gas significantly.

Question: Please explain the option to transfer gas to the Department of Defense.

Answer: Title 10, U.S. Code, Section 7430, as amended by the Energy Security Act (Public Law No. 96-294), authorizes the direct, noncompetitive transfer of petroleum products from the Naval Petroleum and Oil Shale Reserves to the Department of Defense, upon the Secretary of Defense's request, provided that the Department of Energy receives appropriate reimbursement reasonably reflecting fair market value. Western military installations represent an existing, stable, and proximal market for natural gas produced from the Naval Oil Shale Reserves in Colorado. Many of these installations are being required by the Defense Fuel Supply Center of DOD to purchase natural gas competitively for the first time. Both the Departments of Energy and Defense could benefit, operationally and economically, by entering into long-term, noncompetitive supply contracts, indexed to local markets. The Departments have negotiated and agreed on a draft Natural Gas Transfer Agreement to effect that end.

Question: At what prices would this be done?

Answer: The price would have to be reflective of the fair market value of the gas, as required by Public Law No. 96-294. The decision to transfer gas to the Department of Defense would, however, ultimately be contingent on the two Departments agreeing on an index acceptable to both parties. This index would most likely be tied to local spot market prices in the Naval Oil Shale Reserves market region.

Question: What are the biggest risks in pursuing the current existing comprehensive gas protection implementation plan?

Answer: There are a number of risks that could negatively impact the rate of return for the protection program. To summarize, they are:

- Natural gas prices could decline due to an over-supply of gas or reduced demand.
- Initial production from wells is lower than projected and/or decline more precipitously than is typical.
- The government drills an inordinate number of dry holes.
- Local gathering and distribution pipelines are capacity constrained or are unable to move government gas at a reasonable rate.

The investment in the protection program is far from risk free. To the extent that the Government establishes dependable, long-term contracts, as with the military, and invests in its own gathering system, these risks are largely mitigated. Recent plans by industry to construct large interstate pipelines into the Rocky Mountain region fairly well assures a stable natural gas market for the future. Furthermore, the resource has been proven through the successful drilling records of both the DOE and contiguous developers. Dry holes are rare and production seems to be fairly consistent.

Question: Could such a plan be implemented incrementally on a self financing basis, after some initial investment to start the Plan?

Answer: The Gas Protection Plan is designed to be implemented on an incremental basis with capital costs spread over a 4-year period. Under current legislation, revenues from the sale of NOSR gas must be deposited into the General Treasury and cannot be used to offset budget requests. If new legislation were enacted, revenues from one phase could be used to finance the next phase to the extent permitted by the new legislation.

Question: If the total reserve area were to be developed for gas resource production, what specific authorities would be required?

Answer: The Office of Naval Petroleum and Oil Shale Reserves does not currently have the authority to develop the Naval Oil Shale Reserves. In order to do so, legislation to allow development would be required.

Question: What specific options have been examined for such a plan (eg. government production, leasing, etc.)?

Answer: The Office of Naval Petroleum and Oil Shale Reserves has performed preliminary analyses on a variety of options to fund NOSR protection and/or development. Leasing for protection, as opposed to government protection, is clearly less economically attractive and poses a variety of operational problems which would impact the effectiveness of the program. The Office concluded that should any form of third party financing for protection be considered, it would be prudent, if not essential, to obtain legislation to fully develop the resource. A number of partnership, "production sharing", schemes were investigated. This type of arrangement, which basically involves a private party providing the development capital, would typically return between 20 and 33 percent of the revenues to the government. The Office plans to perform a more in-depth analysis of third party financing in the next several months.

Question: What are the advantages and disadvantages of each?

Answer: While additional analyses of Government operation versus a lease or other type of arrangement need to be performed once the direction of the program has been established, in general, it can be stated that Government operation of a development program involves higher risks and up front capital expenditures. This impacts the near-term budget deficit. The advantages would be a potential higher rate of return to the

Government, and the Government would retain control of production. A lease or other type of arrangement mitigates the risks and up-front costs by passing it to the private sector. Such an arrangement would provide the potential for improved operation efficiencies through competitive private management incentives. A lease arrangement also would relieve the Government of an activity which may be more properly suited to the private sector.

Question: Could such a plan be implemented incrementally on a self-sustaining basis after some initial investment to start the plan?

Answer: Any form of self-financing would, however, require new statutory authority to allow the Department to utilize revenues to pay for capital investments and operating and maintenance costs. If the current legislation were to be amended, all protection options could be partially self-financed through sales receipts in the initial implementation period. All NOSR Gas Protection Program options would entail incremental implementation over a number of years. Once capital expenditures were paid for, all protection options considered could be entirely self-financed and return additional revenues to the U.S. Treasury.

Question: What additional exploratory work would be necessary, if any, to determine if extensive gas reserves exist?

Answer: This question must be divided into two major areas--NOSRs 1 and 3 and NOSR-2. NOSRs 1 and 3 require varying amounts of exploratory work. To the south near the existing fields, no exploration is required since all drilling in those areas would be stepouts from existing producing wells. North of this limited area, however, the only means of identifying or quantifying gas reserves is an extensive exploratory effort. Such an effort must include the purchase of several commercially available seismic lines and additional new lines to identify the structural or stratigraphic traps. This work must be followed by the drilling of several deep wells to confirm the presence of hydrocarbons (oil and gas), and several shallower wells to define the extent of their deposits. Since NOSR-2 already has seismic lines available, the task is more limited. The existing seismic analyses has already identified several structural and stratigraphic features which have promise for hydrocarbon accumulation. A small quantity of additional seismic work and several deep exploratory wells will confirm this potential. Several shallower wells will aid in identifying the extent of the reserves discovered during drilling the deep wells.

Clean Coal Technology
Clean Coal #1

Question: How many Clean Coal #1 projects are underway?

Answer: In Round #1 of the Clean Coal Technology Program the seven projects set forth below are moving forward under fully executed Cooperative Agreements:

- American Electric Power Service Corp - Tidd Pressurized Fluidized Bed Combustion (PFBC) Demonstration Project.
- The Babcock & Wilcox Co. - Limestone Injection Multistage Burner (LIMB) Demonstration Project Extension.
- Coal Tech Corporation - Advanced Cyclone Combustor with Integral Sulfur, Nitrogen and Ash Control.
- Colorado Ute Electric Association, Inc. - Nucla Circulating Fluidized Bed (CFB) Demonstration Project.
- Energy and Environmental Research Corporation - Enhancing the use of Coals by Gas Reburning and Sorbent Injection.
- Ohio Ontario Clean Fuels, Inc. - Prototype Commercial Coal/Oil Co-Processing Plant.
- TRW, Inc. - Advanced Slagging Combustor Utility Demonstration Project.

Question: How many are operational?

Answer: Of the seven projects under award in Round #1, three are in the operations phase. They are as follows:

- The Babcock & Wilcox Co. - Limestone Injection Multistage Burner (LIMB) Demonstration Project.
- Coal Tech Corporation - Advanced Cyclone Combustor with Integral Sulfur, Nitrogen and Ash Control.
- Colorado-Ute Electric Association - Nucla Circulating Fluidized Bed (CFB) Demonstration Project.

Question: How many are under construction?

Answer: Of the seven projects under award in Round #1, two are in the construction phase. They are as follows:

- American Electric Power Service Corp. - Tidd Pressurized Fluidized Bed Combustion (PFBC) Demonstration Project.

- o Energy and Environmental Research Corporation - Enhancing the use of Coals by Gas Reburning and Sorbent Injection.

Question: How many projects remain in negotiation or need to resolve serious problems before proceeding?

Answer: In Round #1, there are three projects that remain in negotiation. They are as follows:

- o Combustion Engineering - CQ Inc. -- Coal Preparation Project.
- o Western Energy Co. -- Fuel Upgrading Project.
- o City of Tallahassee - Circulating Atmospheric Fluidized Bed Combustion Project.

Question: When do you expect these projects to be resolved?

Answer: Negotiations are scheduled to be completed on the remaining three projects in Round #1 as follows:

- o Combustion Engineering - CQ, Inc. -- Coal Preparation Project (April 1990)
- o Western Energy Co. -- Fuel Upgrading Project (June 1990)
- o City of Tallahassee -- Circulating Atmospheric Fluidized Bed Combustion Project (August 1990)

Question: How many projects dropped out of the program after being selected?

Answer: Under Round #1, seven projects dropped out of the program.

Question: What were the reasons for this?

Answer: The reasons for the seven projects dropping out of the Round #1 are outlined below:

General Electric (GE) - Integrated Gasification Combined Cycle - Failure of the project to move forward was a direct result of the inability of the participants to get the business commitments needed.

Weirton Steel - Direct Use of Coal in Ironmaking - Negotiations had been completed on this project when a reorganization at Weirton Steel brought in a new Chief Executive Officer (CEO). The new CEO in withdrawing from the project cited reasons that simply reflected a desire to take Weirton down a more conservative path.

Minnesota Department of Natural Resources (MDNR) - Direct Use of Coal in Ironmaking - After several unsuccessful attempts by MDNR to interest a number of steel producers, the Department of Energy took action to deselect the proposal. The reasons for MDNR's lack of success appeared to be the ultra conservative nature of the steel industry and unfavorable market conditions.

M. W. Kellogg (MWK) - Integrated Gasification Combined Cycle - A number of reasons contributed to the failure to initiate this project. These reasons included a lack of rate incentives for emerging technologies, the risk aversive nature of the utility industry, and the WEPCO decision.

United Coal Co. - Coal Waste Recovery - Prior to completion of negotiations, United Coal Co. reorganized and spun-off the research and development groups which had initiated the proposal. As signatory to the proposal and holder of the necessary assets to implement the project, United Coal Co. chose not to continue the project.

Energy International (EI) - Underground Coal Gasification - After repeated attempts EI was unable to obtain the financial backing necessary to proceed beyond the design phase.

Foster Wheeler - Integrated Gasification Combined Cycle - Foster Wheeler was unable to obtain the financial incentives it needed to proceed with its original project proposal sited at West Virginia University. A subsequent attempt at relocating and restructuring the project also failed.

Clean Coal #2

Question: How many Clean Coal #2 projects are under contract?

Answer: In Round #2 of the Clean Coal Technology Program, nine projects as set forth below are under fully executed Cooperative Agreements:

- Bethlehem Steel Corporation - Innovative Coke Oven Gas Cleaning System for Retrofit Application.
- Southern Company Services, Inc. - Demonstration of Advanced Combustion Techniques for a Wall-Fired Boiler.
- Passamaquoddy Tribe - Cement Kiln Flue Gas Recovery Scrubber.
- Combustion Engineering, Inc. - WSA-SNOX Flue Gas Cleaning Demonstration Project

- The Babcock & Wilcox Co. - Sox-NOx-ROx Box Flue Gas Clean-Up Demonstration Project.
- Pure Air - Advanced Flue Gas Desulfurization (AFGD) Demonstration Project
- The Babcock & Wilcox Co. - Demonstration of Coal Reburning for Cyclone Boiler NOx Control.
- Southern Company Services, Inc. - Demonstration of Innovative Applications of Technology for the CT-121 FGD Process.
- American Electric Power Service Corp. - Pressurized Fluidized Bed Combustion (PFBC) Utility Demonstration Project.

Question: How may are under construction?

Answer: Of the nine projects under award in Round #2, two are in construction. The are as follows:

- Bethlehem Steel Corporation - Innovative Coke Oven Gas Cleaning System for Retrofit Applications.
- Passamaquoddy Tribe - Cement Kiln Flue Gas Recovery Scrubber.

Question: How many remain in negotiation?

Answer: In Round #2, there are six projects that remain in negotiation.

Question: When do you expect negotiations to be complete?

Answer: Negotiations are scheduled to be completed on the remaining six projects in Round #2 as follows:

- Trans Alta Resources Investment Corp. - Advanced Slagging Combustor (April 1990)
- Southern Company Services, Inc. - Selective Catalytic Reduction (April 1990)
- Combustion Engineering, Inc. - Integrated Gasification Combined Cycle (May 1990)
- Southern Company Services, Inc. - Low NOx Burner with Advanced Overfire Air (Tangentially-Fired Boiler) (June 1990)
- Otisca Industries, Ltd. - Advanced Coal Beneficiation (October 1990)

- o Southwestern Public Service Co. - Circulating Atmospheric Fluidized Bed Combustion (Pending re-examination of impact of EIS on project)

Question: How many dropped out of the program after selection?

Answer: Only one project, Combustion Engineering, Inc. - Dry Sorbent Injection, dropped out of Round #2 after selection.

Question: For what reasons?

Answer: Both Combustion Engineering, Inc., (the technology owner) and Virginia Power Company (the host site) experienced unanticipated financial set-backs which led first to consideration of restructuring the projects, and finally to a mutually agreed upon decision to withdraw.

"WEPCO" Decision

Question: What remedies are contained in pending clean air legislation in the House and the Senate?

Answer: Remedies for the impact that the WEPCO decision could have on the Clean Coal Technology Program have been included in the pending clean air legislation proposed in the House and Senate. However, each of the remedies have severe limitations and none of them adequately address the issues raised by WEPCO and of concern to industry.

The President's original proposal did protect all CCT demonstrations retrofit and repowering projects.

Question: Are these remedies adequate?

Answer: S. 1630, as approved by the Senate on April 3, 1990, provides adequate protection for temporary CCT demonstration projects, and for permanent repowering projects. For permanent retrofit projects, DOE is concerned that the "rebuttable presumption" regarding capacity factor will generally be rebutted by the utility itself.

If a utility invests substantial capital in pollution control technology, then the existence of the SO2 emissions cap will lead the utility to run that generation unit at relatively high capacity utilization; probably higher than prior to installation of the control equipment. If this happens, then the utility could be forced to undergo new source review, particularly if low NOx burners are already installed, or if the unit design is such that low NOx burners are not practical for the unit. The uncertainty regarding possible emission requirements and delay needed to meet procedural requirements, like ambient air quality modeling, could be sufficient to lead the utility to not only avoid the CCT demonstration project, but also to avoid adding technology altogether and comply with acid rain provisions by switching to low sulfur coal. Such behavior would increase the social impacts of the legislation and increase its direct costs.

H.R. 3030, as reported to the House floor, contains several conflicting provisions related to WEPCO. The provisions specific to demonstration projects are in Section 515. Temporary demonstration projects are adequately protected from new source review. However, permanent demonstration projects are exempt from new source review only if their actual emissions do not increase, based on a comparison of historic actual emissions and future emissions assuming a 70% capacity factor. Most demonstration projects will not pass this criterion, and will therefore be subject to new source review requirements.

Question: If not, what additional remedies are needed?

Answer: Sections 515(d)(2) and (3) of H.R. 3030 (11-9-89 Committee Print) contain the language used in the original Administration proposal. This language adequately protects demonstration projects against new source review by using a "potential-to-potential" test for applicability of new source review regulations. More specifically, if a non-routine change at an existing source did not lead to an increase in the potential emissions of the source, relative to potential emissions before the change, then the change would not constitute a "modification."

This language was unacceptable to some legislators, and was replaced by more restrictive language in the current bills. The Administration is continuing to explore alternative approaches to this problem which may be acceptable to all parties and still not deter demonstration projects.

Budget Priorities

Question: Once again the Administration has severely reduced coal research in the FY 1991 budget. The $110 million request is only 40 percent of the 1990 appropriation. Oil research and development on the other hand is $40 million, an increase of 29 percent above last year. How were priorities determined in order to reduce coal so drastically while increasing oil and gas work?

Answer: The Administration has placed a high priority on encouraging domestic oil production. An important part of this is the urgent need to retain access to marginally producing wells (i.e., to avoid abandonment and plugging) until that time when advanced recovery techniques can be used. The FY 1991 request for most coal activities is reduced from the FY 1990 appropriation in response to fiscal constraints, and the need to concentrate on getting technologies to the marketplace in the near term. The FY 1991 coal R&D request is still more than twice the oil and gas request, and thus the overall Fossil Energy request should not be interpreted as assigning a low priority to coal activities.

Question: Even the levels requested to OMB for coal were reduced severely from current levels. Why?

Answer: DOE's budget request is formulated using guidelines that reflect the Administration's efforts to practice fiscal responsibility. Adhering to these guidelines for FY 1991 means that many programs will be funded at a lower level than the previous year's appropriation. Nevertheless, the Department still believes that the program requested in FY 1991 is viable, can produce significant benefits, and is sensible given the need for fiscal restraint.

Question: Doesn't it make as much sense to support coal technologies as it does to support oil and gas research, which the budget does, at least at historical levels?

Answer: Based in the high priority and urgency associated with FY 1991 oil and gas initiatives, and the relatively low historical funding levels for oil and gas R&D versus coal, we believe that, then the funding strategy reflected in our FY 1991 submission to Congress is appropriate.

Question: A statement on page 14 of the budget justifications reads as follows: "While there are promising technological approaches for adding to domestic oil production, the magnitude of our country's appetite for liquid fuels, compared to the relatively small size of the domestic resource (oil accounts for only about 3 percent of U.S. estimated recoverable fossil fuel reserves) and the uncompetitive economics of current, more advanced technologies suggests that conservation and use of other fuels must play an increasingly important role in any practical and economic strategy to reduce oil import dependence."

Based in that, why are there increases for oil research and massive decreases to research on liquids producing technologies, such as coal liquefaction and oil shale?

Answer: While the U.S. oil resource accounts for a relatively small portion of the domestic fossil fuel resource, there is still adequate potentially recoverable domestic oil to play an important role relative to our country's near- and mid-term economic and energy security. The increased funding emphasis on oil is based on the urgency associated with trying to forestall increases in the number of wells expected to be abandoned and plugged in the near-term. Abandonment and plugging significantly increases the cost to re-enter a field to deploy advanced recovery techniques due to re-drilling costs. A variety of opportunities currently exists where Federal support in conjunction with industry is of particularly high value.

While liquids from coal and oil shale may prove to be important long-term sources of liquid fuels, they do not have a similar urgency as our oil initiatives. Given budget constraints, we have thus given a higher funding priority to these initiatives.

Question: The same page of the budget justifications refers twice to "non-productive regulations" with regard to the use of non-petroleum fuels. What are these regulations and how are they counterproductive?

Answer: There are a variety of regulations, including Federal as well as State and local ones, that affect the use of non-petroleum fuels (i.e., primarily coal in this case). The impact of these regulations ultimately shows up in the cost of using coal. Whether regulations are sufficiently "non-productive" to justify change us a matter of judgement, since regulations tend to result in benefits as well as costs. A number of participants in the public input process that produced the National Energy Strategy Interim Report, however, identified regulatory obstacles which they considered not adequately productive to justify these regulations in their current form. For example, a number of regulations associated with the Surface Mining Control and Reclamation Act (SMCRA) and regulations administered by the Mine Safety and Health Administration were criticized for causing unnecessary delays, increasing costs, retarding the use of improved technology, etc.

Question: Page 15 of the budget refers to an "increased emphasis on high efficiency system development." Show in the budget where you have increased emphasis over FY 1990 for high efficiency systems.

Answer: In the process of formulating the FY 1991 budget request, a higher relative priority was placed on activities leading to the development of higher efficiency systems. This increased emphasis, therefore, affected the relative levels of funding within the FY 1991 request. In some cases, such as activities supporting integrated gasification combined cycle with a molten carbonate fuel cell or a gas turbine and pressurized fluidized bed, the result was a FY 1991 request larger than the FY 1990 request.

Liquids Programs (Other than Oil)

Question: For the past two years this hearing has discussed the problem of dependence on foreign sources of oil for liquid fuel requirements, and the need to develop alternatives to oil-based fuels. This year our import situation is even worse, but except for increased emphasis on oil production, the Administration continues to ignore programs in the liquid fuels area. Severe reductions are suggested for coal liquefaction, oil shale, and liquids from methane. Is this consistent with the recommendations of the National Research Council (NRC) report on liquid fuels, recently completed?

Answer: The requested funding for coal liquefaction, particularly direct liquefaction, and oil shale are not consistent with the recommendations of the NRC report. However, the NRC report was completed too late to serve as input to the FY 1991 budget development process.

While we will be considering the NRC recommendations carefully as we prepare the FY 1992 budget request, it should be noted that the NRC study focused strictly on developing a strategy and R&D plan for liquid transportation fuels. The study committee was not asked to consider:

- o Potential budget limitations
- o Competing priorities (i.e., R&D not related to transportation fuels)

These factors will also play a role in our FY 1992 budget planning process.

We believe that the liquids from methane program proposed by DOE under the Advanced Extraction and Process Technology line item is consistent with the NRC recommendations, which stressed that the DOE program should focus on fundamental research.

Question: What are its recommendations?

Answer: The NRC report partitioned potential R&D activities related to transportation fuels into 11 areas and assigned each with a high, moderate or low priority for Federal support. The report also discussed specific R&D activities relative to each area. The 11 areas and Federal funding priorities are listed below:

Funding Priority	R&D Area
Major	1. Participation in R&D and Technology Transfer for Oil and Gas Production
	2. Liquids Production from: - Coal (Direct Liquefaction) - Western Oil Shale
	3. Environmental and End-use Considerations (heavily oriented towards fuel-engine emissions -- not a FE R&D area)
Moderate	4. Coal-oil Coprocessing
	5. Tar Sands (Extraction)
	6. Petroleum Residuum, Heavy Oil and Tar Sands Conversion Processes
	7. Biomass Utilization (not FE activity)
	8. Coal Pyrolysis

Modest	9. Processes for Producing Methanol, Methanol-Derived Fuels, or Fischer-Tropsch Liquids from Synthesis Gas
	10. Direct Methane Conversion
	11. Eastern Oil Shale

Question: Do you agree or disagree with its basic finding?

Answer: We generally agree with the study's basic findings given the following assumptions explicit or implicit in the study:

- o Focus strictly on transportation fuels R&D
- o No major funding constraints
- o Near-term and longer-term objectives both have a high priority

However, these assumptions are not consistent with those used in DOE's FY 1991 planning/budgeting process -- other priorities besides transportation fuels existed, funding was highly constrained, and activities that could produce near-term results were given additional priority.

The NRC report was not completed in time to serve as input to the FY 1991 budget process. As we enter the FY 1992 budget planning cycle, we will be carefully considering the study's recommendations, as well as re-examining basic assumptions and competing priorities.

Question: What technologies are most likely to become cost-competitive with imported oil?

Answer: The only technologies likely to be competitive with imported oil at prices close to those existing today are technologies related to enhance oil recovery, which is focused on recovering part of the huge amount of oil that is left behind in domestic reservoirs after conventional technologies have reached their technical and/or economic limit. At somewhat higher costs domestic tar sands development and technologies such as mild coal gasification and coal-oil coprocessing would start to become attractive. At still higher costs liquids from coal and oil shale would be economic.

Question: In what time frame could this occur?

Answer: The time frame is difficult to predict since it depends on oil prices, which are not very predictable based on past experience, and technology cost estimates, which are not precise and change over time as R&D progresses. However, our best current guess is that technologies related to enhanced recovery of oil are likely to be competitive in the near-term while the more expensive synthetic fuels technologies would constitute longer-term options (e.g., in the 2005 - 2010 time frame following successful R&D to reduce costs plus a demonstration project to verify cost and performance).

Question: Will large reductions in government support delay the introduction of such technologies?

Answer: Large reductions would likely increase the time required to develop technologies. Whether this affects the time of commercial introduction depends on oil prices.

Question: What are the relative contributions of carbon dioxide from alternative fuels technologies compared to oil?

Answer: The attached table, which compares greenhouse gas emissions (primarily CO2 but includes other greenhouse gases where applicable as indicated in footnotes) from alternative fuels to current technology (i.e., oil), is taken from the National Research Council study entitled "U.S. Production of Liquid Transportation Fuels: Costs, Issues, and Research and Development Directions."

Table 5-1 Approximate Greenhouse Gas Emission per Mile Relative to Petroleum-Powered Internal Combustion Engines

Fuel and Feedstock	Percent Change
Current Technology	
CNG, gasoline, diesel, or methanol from biomass[a]	-100
Gasoline and diesel from crude oil[b]	0
CNG from natural gas[c]	-19
Methanol from natural gas[c]	-3
Gasoline from oil shale[d]	+27 to +80
Methanol from coal (baseline)[c]	+98
Potential Advanced Technology	
Gasoline from coal or shale using nonfossil sources for process heat and hydrogen[e]	0

[a] Percent change is for CO_2 only. This is true only for biomass processes that do not use fossil fuel, that do not displace land from forest that would otherwise sequester carbon in its biomass, and that are grown every year so that carbon dioxide from fuel use is taken up by the crops.

[b] Should be increased by 25 to 33 percent for thermally enhanced oil recovery.

[c] The analysis considered emissions of CH_4, N_2O, and CO_2 from the production and transportation of the primary resource (coal, natural gas, or crude oil); conversion of the primary resource to transportation energy (e.g., natural gas to methanol); distribution of the fuel to retail outlets; and combustion of the fuel in engines, except as noted. N_2O emissions from vehicle engines were not included. Emissions of ozone precursors, chlorofluorohydrocarbons (CFCs) from air-conditioning systems, and water (H_2O) were not considered (available data and models do not allow estimation of the greenhouse effect of emissions of ozone precursors; CFC emissions are independent of fuel use; and H_2O emissions from fossil fuel use worldwide are a negligible percentage of global evaporation). The composite greenhouse gas is actual mass emissions of CO_2 plus CH_4 and N_2O emissions converted to mass amount of CO_2 emissions with the same temperature effect.

[d] Considers only CO_2.

[e] Nonfossil sources could be biomass, nuclear, or solar energy devices.

SOURCE: Adapted from DeLuchi et al. (1988) and DeLuchi (1989).

Oil Shale

Question: In the oil shale program, no work is contemplated in FY 1991, yet this is one of the highest priorities of the NRC study. Do you think you would get industrial support for establishing an oil shale program, such as currently exists in the coal liquefaction area, that looks at advances in technology on a research and bench scale, based on areas that those familiar with the field choose, and, once technological advances are established, test them at a small pilot scale level?

Answer: DOE does recommend a core program in the FY 1991 Budget to carry out characterization and fundamental research, while balancing other national priorities.

On in-situ technology, Occidental Oil Shale, Inc. (OOSI) is recommending a jointly funded project for a modified in-situ (MIS) proof of concept demonstration facility. The OOSI project as now contemplated proposed funding of 50% by OOSI, 0-15% by the State of Colorado and 35-50% by DOE.

On surface retorting technology, DOE is not aware of any explicit indication of interest for cost-shared R&D and scaleup by anyone in industry.

Question: Would the current work at Lawrence Livermore Laboratory or the work at Western Research Institute be applicable?

Answer: Yes, some of the research at Lawrence Livermore National Laboratory (LLNL) and Western Research Institute (WRI) would be applicable (for a pilot plant program like direct liquefaction). The characterization data on reference shales being developed at WRI would be useful in design considerations for developing energy balances and the fate of elements that might be of environmental concern. Also, the LLNL Hot Recycle Solids (HRS) retort pilot plant data would be applicable in developing process designs for similar types of processes. LLNL studies of environmental issues, particularly in the combustion of retorted shale, would be useful in addressing environmental design issues. The HRS would be one candidate surface process for use in a pilot plant program, but other competitive processes should also be considered.

However, additional funding for oil shale pilot plant facilities is not recommended when considering other national priorities.

Question: The NRC study does not recommend funding for eastern oil shale processes at this time. What is your assessment of that conclusion?

Answer: The NRC study in it recommendations included eastern oil shale under a priority called "modest funding areas." They recommended no development at this time because they judged that economic use of this resource would come much later than coal or western oil shale. This also seems to be supported by industry interest, which is almost exclusively in western oil shale.

We agree with the NRC on eastern oil shale research. However, DOE has requested modest total funding for Oil Shale in FY 1991 for a core program to include characterization of reference oil shales and fundamental research. No additional work is justified at this time when considering other national and program priorities.

Question: What are the advantages and disadvantages to eastern shales?

Answer: Possible advantages of eastern shales include closer markets and a more developed infrastructure. Water availability may be less of a problem for a large industry in the east. Eastern oil shale resources may be obtained from private landowners, whereas most western deposits are subject to Federal leasing policies.

Disadvantages of eastern oil shales include thinner, and for the most part, less well defined deposits. The typical eastern oil shale produces less liquid oil per ton, and more organic residue, by conventional thermal processing, such as is typical of most of the more developed processes. Eastern shale oil has more aromatic components than western shale oil and its refinability and associated costs are less well known than for western shale oils. Eastern oil shales and the oil produced from them are higher in sulfur content than western oil shales and oils.

Question: The NRC study doesn't address modified in-situ technology developed by Occidental Oil Shale Company. Occidental has requested government support for a large scale development on an oil shale tract leased from the government. When will it be complete?

Answer: Occidental Oil Shale (OOSI) has submitted an unsolicited proposal for the development of a plan for a Modified In Situ (MIS) demonstration project. The proposed plan has been favorably reviewed and is now being negotiated as a cooperative agreement. Award is expected to be in late May 1990.

The final report is expected to be complete in September, but a preliminary report is scheduled to be available in June.

A project based on the plan would be contingent on funding. It would require a three-year design and construction phase prior to commencement of operations. The total duration of the project being described by Occidental is 7 to 10 years.

Question: On a technological basis, is the size of the facility contemplated by Occidental Oil the next logical step in developing in-situ technology?

Answer: The retort size proposed by OOSI would be the next logical step. The main purpose of the project would be to demonstrate management of a continuous operation and the orderly sequencing of construction, retorting and quenching of successive retorts. The retorts proposed are full commercial scale; each retort is to be 165 ft. x 165 ft. x 278 ft. in height.

Two retorts in different stages of retorting are proposed to be in operation at the same time throughout the operating life of the project. A total of 17 retorts would be processed in a seven-year operating cycle. Oil production from the two operating retorts will average 1,206 barrels per calendar day.

Question: Would it make sense to use existing surface technology, or would it be better to test new concepts in such projects?

Answer: If funded, an MIS proof of concept demonstration project could provide useful technical, economic and operational information. However, development of surface technology is independent of MIS technology development. There might possibly be cost savings by integrating surface and MIS retorting research projects, but the choice of surface technology to be tested should be decided through a careful and full evaluation of the available and new processes by experts skilled in the art. If industry interest becomes evident, those participating should lead in selecting the technology.

Question: If you had an oil shale process development program, how long would it be before new surface processes might be available at the Occidental site?

Answer: Six to 12 years as follows: A year or two would be needed to develop a planned approach. This would include:

- exploring with industry their interest in the program;
- a screening evaluation to select a process to develop from existing and advanced processes;
- planning, scheduling and developing a cost estimate for the program.

Five to 10 years would be needed for the second phase which would involve implementation of the plan to demonstrate the selected technology. Size could vary depending upon the technology. Technical availability would not necessarily coincide with economic viability however.

Question: Is there more than one alternative expected to be present in the plan being developed by Occidental?

Answer: Occidental Oil Shale Inc. (OOSI) is now preparing a plan for a project. The proposal, based on that plan, is expected to recommend a single configuration optimized to demonstrate the Modified In-Site retorting technology.

Question: For example, it is necessary to include construction of a fluidized bed combustor for the sale of electricity as part of the project?

Answer: The circulating fluidized bed combustor (CFBC) will likely be included in the project to test sulfur sorbency of combusted spend shale, which contains substantial amounts of limestone-like materials, This may eliminate the cost of flue gas cleanup systems needed for alternative combustors. Coal firing will also be tested, and, if the tests are successful, will demonstrate the potential of using spent shale as a sulfur sorbent in coal-fired applications. In addition, by including the CFBC, electricity can be produced to provide additional revenues and reduce the overall cost of the project.

Question: Would modified in-situ technology open up significant new resources not available through surface technology? If so, please describe the general scope and location of such resources.

Answer: The modified in-situ (MIS) technology will not open up any significant new resources currently not available through surface retorting. However, deep deposits will thick overburden are costly to access and develop. If the MIS technology reduces costs and operates in an environmentally acceptable manner, the date of utilization of these deep deposits might be advanced.

Most of the resource that is deep and thick is in the center of the Piceance Creek Basin. Deposits there are as thick as 2000 ft. with as much as 1000 ft. of overburden. The deep deposits are a significant portion of the total oil shale.

Question: Have problems with possible pollution of underground water been addressed sufficiently for this technology?

Answer: Possible harm to underground water is of concern to Occidental Oil Shale Inc. (OOSI) and DOE. DOE will require in the ongoing planning phase that this and other environmental issues be properly addressed. OOSI is performing analyses of their previous MIS work and is conducting tests to develop acceptable solutions to this issue. The operational phase will not be initiated until all environmental issues have an acceptable resolution.

Question: What is the environmental status of the oil Occidental underground retorts?

Answer: Retorting activity at Occidental's Logan Wash facility was terminated in 1983. During the subsequent year all accumulated process and mine water was re-injected into the retorts to quench the reactions. Since then, all mine water collected has been re-injected periodically to further cool the retorts and to remove leachable materials from the spent shale remaining in the retorts. The mine is nearly dry because it is high on the basin rim, and therefore, produces little water. The only current permit held on the facility is a water discharge permit for mine water, which is not used because all water is recycled. Occidental could formally shut in the facility and abandon the mine, but has not because it feels retort abandonment data can still be obtained which will be useful in designing the C-b lease tract facility.

Question: Occidental claims that shale from this project would be about $30 a barrel. Have you analyzed any economics on this technology either recently or in conjunction with previous DOE funding of it?

Answer: Funding toward developing a plan for the Occidental Oil Shale Inc. (OOSI) began just recently and has not yet produced costs for the project (based on revisions to earlier work done by an A&E firm for OOSI). The draft report is due in June.

DOE has not performed a detailed independent analysis of the OOSI economics, but the earlier work has been reviewed. The review raised a few questions which should be resolved as the current plan is developed.

Question: Is there any indication of interest in oil shale work at Lawrence Livermore National Laboratory?

Answer: Several companies, who have oil shale interests, monitor and give verbal support to the LLNL R&D work. The LLNL process has features similar to a process under study by a major company. That company follows the LLNL work. However, DOE has not been advised of any particular funding interest in the LLNL process. Apparently, interest in sharing the funding of surface retorting research is lacking, or weak, at this time. Some companies believe processes will be available when needed.

Question: Is the processing facility operating?

Answer: Lawrence Livermore National Laboratory (LLNL) has recently completed construction, modifying their one-ton-per-day Hot Recycle Solids (HRS) Retort to increase capacity to 4 tons per day. It has undergone shakedown tests under cold flow conditions and is presently being tested under warm flow conditions. Tests under operating conditions are scheduled for June of this year.

Question: To continue operations in FY 1991, what would be the costs?

Answer: Continuing this work at Lawrence Livermore National Laboratory would cost $4 million in 1991.

Question: What could be accomplished?

Answer: With $4 million funding in FY 1991 the following research would be cost done at LLNL.

- Continue cold and hot flow tests in the 4 ton per day (tpd) Hot-Recycled-Solids (HRS) retort to obtain scaling factors for a 100 tpd field unit.
- Continue research on basic oil shale retorting processes.
- Continue development of a steady-state mathematical model describing the HRS retorting process.

Given the lack of industry interest in co-funding, however, and the fact that similar work is being pursued with private funds the Department does not recommend this additional funding.

Coal Liquefaction

Question: In direct liquefaction, the budget is reduced 75 percent. This is one of the high priority areas determined by the NRC study. Does your 1990 program conform in general to the kind of program suggested by the NRC?

Answer: Yes, the Direct Liquefaction Program elements that were continued and initiated in FY 1990 are in close conformity with the recommendations in the NRC report. The NRC accorded direct liquefaction a major funding level recommendation (highest priority). They recommend that the goal of the program should be to develop technology that would be competitive with petroleum at $30 per barrel or less. As a result of new activities initiated in FY 1989 and FY 1990, the major elements of this program will be in place by the end of this fiscal year.

Question: What components of the program will be reduced in 1991?

Answer: In FY 1991, no funds are requested for proof-of-concept (pilot scale) testing at Wilsonville. In addition, new activities initiated in FY 1989 and FY 1990 will not be funded. These include research and development in advanced process concepts, construction of the PETC bench-scale unit, exploratory research in preconversion processing, follow-on work in alternate bottoms processing technology, and completion of the direct liquefaction baseline design. Technology base research and funds for technology assessments and research guidance studies will be reduced.

Question: What do you expect to accomplish with the remaining funds?

Answer: The funds requested in FY 1991 are sufficient to continue ongoing research in two-stage liquefaction, coal-oil coprocessing, and technology base research including PETC in-house activities at a reduced level of effort.

Question: What work will have been accomplished on the bench scale unit at the Pittsburgh Energy Technology Center by the end of 1990?

Answer: Procurement for the design and construction of the PETC direct liquefaction bench scale unit was initiated in FY 1989, and the contract decision will be made by the end of the calendar year.

Question: If the facility is not built, how much will have been spent on it? To what avail?

Answer: If the design contract is awarded, $1.5 million will have been spent on design and $0.98 million on initial construction. This will provide for the design of the bench scale unit at PETC or wherever such a unit would be constructed.

Question: What would it cost to complete?

Answer: It is estimated that an additional $2,300,000 would be required to complete construction of this unit, if the initial appropriations are all spent on the in-house facility.

Question: If the Wilsonville pilot plant were to operated in 1991, what research could be accomplished there? At what cost?

Answer: Wilsonville is presently developing and evaluating process improvements in the close coupled catalytic two-stage process configuration. This activity could continue in FY 1991. The major focus would be on the use of low-ash coals to increase liquid yield; continuing to establish the process trade-offs between catalyst addition rate, reactor throughput, and liquid yield, and establishing the process conditions required to produce a lighter (more valuable) product slate. DOE funding requirements for FY 1991 would be $9,000,000 for operations. Industrial cofunding (EPRI, AMOCO) would be $600,000 (7%).

Question: Do you agree with the NRC study conclusion that there are research areas that can be addressed to reduce liquefaction costs to $30 per barrel?

Answer: Results from our ongoing research guidance studies and economic evaluations support the NRC study conclusion that there are research areas that can be addressed to reduce liquefaction costs to $30 per barrel or lower.

Question: If so, what areas of the technology need research in order to attempt to reach this result?

Answer: Our studies show that there are a number of technology areas that show potential for cost reduction. In general, the advances in each area tend to be evolutionary in nature rather than "breakthrough" technology, but the cumulative potential for cost reduction could result in reducing process costs to below $30 per barrel. Current technology is estimated to be competitive with crude oil at about $35 per barrel. Areas for technology improvement include:

- Technology to establish the best system to integrate coal cleaning technology with the liquefaction process. Low-ash coals provide higher liquid yields and lower cost ash removal.

- Technology to develop more active, more stable, and/or less expensive catalysts. Improved catalysts would lead to higher yields, higher reactor productivity, and better product quality.

- Technology to reduce the present tendency of reacting coal fragments to recombine and form relatively unreactive materials. This provides potential for improvement in yield, quality, reactor productivity and hydrogen utilization. In our program, this initiative has been identified as preconversion processing.

- Technology to allow removal of the oxygen in coal as carbon oxides rather than water. Savings in hydrogen requirements would be significant.

- Technology to simplify and provide lower-cost options for ash removal and bottoms processing.

Question: What research is being done in 1990 and 1991 and at what cost to do this?

Answer: In 1990, research will be initiated in advance process concepts, preconversion processing, and alternate bottoms processing technology. These activities will include work in all the areas identified in the preceding question. Total funding for these activities is estimated at $4,500,000 in FY 1990. No funds are requested for these activities in FY 1991.

Question: How much of the FY 1990 and FY 1991 program are related to coprocessing?

Answer: In FY 1990, $1,356,000 will be spent on coprocessing. This includes two bench-scale process development projects and several smaller-scale exploratory and technology base activities. In FY 1991, $1,307,000 has been budgeted to continue these activities.

Question: The NRC study suggests rather limited application of this technology unless "synergisms" between coal and oil are found. Do you agree?

Answer: We agree that coprocessing should be considered as a transitional technology with, as we see it, primarily application as a retrofit to petroleum refineries that already have residual oil catalytic upgrading facilities. In that sense, the application is limited since, at present, only a few refineries in this country have that capability. As the price of petroleum increases, we would expect more refineries to add heavy oil catalytic upgrading facilities. In such refineries, the economic driving force for subsequent addition of coal-oil coprocessing capability is the leveraging down of feedstock costs by adding low-cost coal to high-cost petroleum. This must be balanced against the added costs for coal handling, perhaps lower reactor productivity, slurry handling and ash removal facilities, as well as increased hydrogen usage. Our studies project that with present coprocessing technology, this retrofit could be economically attractive at petroleum crude prices in the range of $27 to $30 per barrel. In the NRC report, it is not clear what is meant by the word "synergism." In our economic projections, unexpected or extraordinary improvements in reactivity, liquid yields, or product quality is not required in order for coprocessing to be competitive.

Question: Are there indications of such "synergisms?"

Answer: At least one "synergism" applicable to coal-oil coprocessing has been identified. In catalytic conversion of heavy petroleum resids, the catalyst is rapidly poisoned by certain heavy metals, particularly vanadium, that exist as organo-metallic compounds in the oil. This greatly increases catalyst cost and makes the process quite expensive. When coal is added to the resid, these metals are found to adsorb preferentially on the ash particles in the coal and, thus, help protect the catalyst from this type of deactivation. Experimental and analytical techniques are being developed to explore and identify potential "synergisms" in reactivity or selectivity, but this work is in its early stages and no definite conclusions can be drawn.

Question: Do you have any applications of this technology above the bench scale in FY 1990?

Answer: In the coal liquefaction research program, there are no definitive plans to test this technology above the bench scale in FY 1990. A coal-oil coprocessing demonstration project was awarded DOE funding in Round I of the Clean Coal Program Solicitation. If this project proceeds as scheduled, the industrial sponsors could elect to evaluate their technology at a larger scale such as Wilsonville to provide additional data for their commercial design. If so, we are prepared to cooperate with them to arrange this test.

Question: In indirect liquefaction, the NRC recommends only a bench scale development process. Do you agree?

Answer: We agree that Fischer-Tropsch development which was the focus on NRC study would be at this time more appropriately carried out in bench scale units. In addition the indirect liquefaction program also includes bench scale work on oxygenate octane enhancers which were not covered in the NRC study.

Question: NRC indicates that methanol processes are much more expensive than other alternatives for transportation fuels - Do you agree?

Answer: The NRC study estimated that the equivalent petroleum crude cost for producing methanol from coal is in the $52 - $53 per barrel range, as compared to their projections for direct liquefaction at $38 per barrel of crude and compressed natural gas at $32 - $33 per barrel of crude. It appears that the NRC did not consider co-production of methanol and electricity, such as can be produced in the Once Through Liquid Phase Methanol process, in their analysis. Chem Systems Inc., in a study for the Department of Energy's Office of Policy, Planning and Analysis, estimated the cost of methanol at $0.57 per gallon using the same discounted cash flow as the NRC study. This is equivalent to a crude selling in the $36 - $38 per barrel range.

Question: Do results from the LaPorte Facility confirm or rebut this?

Answer: Chem Systems, Inc. in a study for the Department of Energy's Office of Policy, Planning and Analysis estimated the cost of methanol at $0.57 per gallon using the LaPorte data for co-production of methanol and electricity with the same discounted cash flow (10 percent) as used in the NRC study. This is equivalent to a crude selling in the $36 - $38 per barrel range. More recent results from LaPorte indicate costs could be several cents per gallon less than this.

Question: Are there any available worthwhile processes not involved in transportation fuels which could use pilot facilities such as LaPorte?

Answer: A facility similar to LaPorte would be useful for developing other liquid phase concepts including processes for producing chemicals from synthesis gas. For example, Air Products and Chemicals, Inc. is conducting research under a Department of Energy contract to develop concepts for producing methanol/dimethyl ether mixtures which may have application to producing both octane enhancers for transportation use as well as chemicals and chemical intermediates for other applications.

Question: What would the cost be of the Air Products program at LaPorte in FY 1991 and what would be accomplished?

Answer: The requirement for modification and continued operation of the LaPorte proof-of-concept facility is estimated at $4.5 - $5.0 million per year. In the Air Products program, the LaPorte facility would be modified to conduct studies to evaluate the conversion of synthesis gas to mixed alcohols and methanol/dimethyl ether mixtures for use as gasoline octane enhancers.

Question: NRC also states that there is substantial private activity in this area. Do you agree?

Answer: Yes. We agree that there is substantial private activity in natural gas to chemicals/liquid fuels research. A substantial portion of this activity, however, is carried out overseas by foreign companies. Domestically, work on coal derived synthesis gas to liquid fuels does not appear as broad as suggested by the NRC study.

Question: How much private activity do you support in FY 1990?

Answer: FY 1990 funding for private activity, including industrial and university research in FY 1990, in the indirect liquefaction program is $4,835,000 including $1,777,000 for the LaPorte program. The remaining FY 1990 funding of $3,640,000 is used for PETC in-house/generic bench unit and National Laboratory research.

Question: Do you believe there are areas in which research could reduce indirect liquefaction costs? Describe them and how your FY 1990 program addresses them.

Answer: Our analysis indicates that further improvement in catalyst and slurry reactor development are the two major areas which could reduce indirect liquefaction costs. Both activities have been supported in the FY 1990 program including two new procurements for Fischer-Tropsch iron catalyst development and novel catalysts for synthesis of oxygenate octane enhancers for synthesis gas.

Question: To what level might costs be reduced?

Answer: Our analysis indicates that, based on the current technology under development, a cost of $36 per barrel of equivalent crude might be reached with all liquid fuel production. With electricity cogeneration the liquid cost might be reduced to $28 per barrel of equivalent crude. An effort is now underway to assess the impact on further cost reduction with more improvement in catalyst and process optimization.

Question: What would be the cost of completing the bench scale unit at the Pittsburgh Technology Center?

Answer: The total cost of completing the design and construction of the indirect liquefaction bench scale unit at Pittsburgh Energy Technology Center is estimated to be $5,500,000. $2,480,000 has been obligated with prior year funding. We estimate that additional funding of $3,020,000 would be required to complete construction of this unit. However, we are not recommending construction of the bench scale unit at this time, which is why no funds are included in the FY 1991 request.

Question: Do you have any indication that industry would use such a unit?

Answer: Preliminary discussions have been held with industry on the use of this unit. Solicitation for the industry use of this unit is now in the planning stage.

Surface Coal Gasification

Question: The NRC study suggests investigating coal pyrolysis (mild gasification) as an integrated part of coal liquefaction processes. Do you have any plans to consider this approach?

Answer: Yes, the Department of Energy is presently evaluating concepts for the integration of mild gasification with direct liquefaction. METC is currently looking at a means of utilizing char, is conducting studies on characterization and upgrading of mild gasification liquids, and will initiate fundamental studies on catalytic hydropyrolysis to increase liquid yields. If results of the system studies are positive, expanded experimental studies will be undertaken at the bench scale.

Question: Does it make sense?

Answer: Systems analyses and economic studies are currently underway to assess the synergism of combining direct liquefaction and mild gasification concepts. Preliminary results suggest that the integration may provide a method for reducing the cost of hydrogen for use in direct liquefaction. The key integration issue is the direct transfer of hot char to the gasifier which could reduce oxygen requirements and result in lower hydrogen cost.

Question: Could this be done with the same contractors who are looking at other applications of this technology, or should it be done on a small scale in-house?

Answer: Some of the same contractors doing mild gasification work could evaluate the gasification of hot char to produce hydrogen, which would be a logical extension of their work.

Question: What is the status of scaling up mild gasification technology from the four small units now in operation?

Answer: The Institute of Gas Technology/Peabody, Western Research Institute/AMAX, and University of North Dakota Energy and Environmental Research Center/AMAX have completed construction of the 100-pounds-per-hour coal-fed units, and operation of these three units is underway. The Coal Technology Corporation's 1000-pound-per-hour coal-fed unit is in detailed design and construction. By the end of this fiscal year, it is anticipated that the mild gasification process development and char upgrading studies will provide sufficient information to allow for scale-up design of one mild gasification process concept to the 1-ton-per-hour scale. The FY 1991 request of $1,000,000 will permit detailed design and initiation of procurement of some of the long-lead items for construction of the 1-ton-per-hour unit in FY 1992.

Question: For these (mild gasification) processes, how much of the coal is recovered as liquids?

Answer: The mild gasification concepts provide a suite of value added solid, liquid, and gaseous products. Under mild gasification conditions, liquid yield varies from 10 - 25 percent, depending on the mild gasification process, coal type, and process conditions.

Question: What are the product uses projected for the char?

Answer: The char must be upgraded to a value-added solid product to be competitive in today's market. Examples of these solid products are metallurgical and form coke, pellets for copula for direct iron ore reduction, carbon black, carbon electrodes, and activated carbon. It is anticipated that in the longer term time frame, the char will be competitively utilized for its fuel value and possible to produce hydrogen for production of transportation fuel by application of direct coal liquefaction technology.

Question: What is the status of the char to clean carbon process?

Answer: The Western Research Institute and AMAX R&D Center team was chosen as one of the four mild gasification PDU contractors. Their concept calls for use of the mild gasification char to produce carbon black. WRI/AMAX have completed design for the 50-pound-per-hour char-upgrading unit. Procurement of major items has been completed, and construction is scheduled for completion during FY 1990.

Question: What will be accomplished with the funds (char to clean carbon process) in FY 1990?

Answer: With FY 1990 funding, the 50-pound-per-hour char-upgrading unit will be constructed and the unit will begin operations to produce upgraded char as a product.

Question: Would additional funding be required in FY 1991 and after to continue development of this process? If so, how much over what years?

Answer: With FY 1990 funding, the 50-pound-per-hour char-upgrading unit will be constructed, and operation to upgrade char begun. AMAX anticipates that some modification and continued operation of the char to carbon process research unit will be required after the completion of the present effort with FY 1990 funds. The contractor's estimated cost is $500,000 in FY 1991 to complete upgrading technology to meet required market.

Liquids from Methane

Question: Please explain the new management plans for the gas-to-liquids program in FY 1990.

Answer: No changes are proposed for the program implementation roles of METC or PETC. The program management changes occur in headquarters program planning and management, which is consolidated under the Office of Technical Coordination (OTC), which also manages the other fundamental and exploratory research in fuel chemistry and petroleum process chemistry. This plan permits streamlining of Headquarters management and planning with increased focus and coordination of related activities. Funding for this project is in the crosscutting Advanced Extraction and Process Technology program, under the Supporting Technology and Environmental Research sub-program.

Question: Why have you changed management responsibility?

Answer: The changes proposed in the management plan provides for streamlining Headquarters program management and planning. It focuses this breakthrough-oriented research in the Office of Technical Coordination who is also responsible for other breakthrough research. As a result the opportunity to seek program synergies with other fuel chemistry and petroleum process chemistry research that is conducted within the office is increased.

Question: The NRC study concludes that this research is of relatively low priority. Do you agree?

Answer: The NRC Report recommended a "modest" research priority for gas-to-liquids research and also recommended that this work be focused on fundamental research -- seeking breakthroughs. Our understanding of the thrust of the NRC recommendation was the research on these technologies should focus on seeking breakthrough rather that costly process scale-up, until processes with significantly improved economics are identified and evaluated. The current program includes considerable industry cost-sharing which is considered to be a good indicator of industrial interest. Although the NRC Report came to late for FY 1991 planning, FE has already reached a similar conclusion. The consolidation of activities of activities into the fundamental and exploratory research program of the AEPT is consistent with both the earlier FE management decision and the NRC recommendations.

Question: What are the potential used of the technology?

Answer: This technology has a number of potential uses which include: production if high value liquid hydrocarbon transportation fuels, octane enhancers and oxygenates, and production of intermediate products which are important feedstocks for high-value chemicals. For example, one innovative process developed by PETC, the Oxyhydrochlorination Process, has potential applications to high-value chemical intermediate production as well as hydrocarbon fuel production.

The technologies being explored can use either methane from natural gas or from process-derived streams in direct and indirect liquefaction.

Question: What industrial interest is there in this area?

Answer: There exists substantial industry interest and cost-sharing including cofunding by GRI. The projects with industry at METC and PETC have substantial cost-sharing. Recent strong industry interest has been expressed in cofunded technology transfer of the PETC-developed oxyhydrochlorination process (AMOCO and Dow-Corning). Other recent interest has been expressed to DOE for participation in jointly-funded liquids-from-methane research by other groups of firms.

Question: What potential advantages are there for this technology over current processes?

Answer: Current processes require very inefficient conversion of methane to synthesis gas (CO/H_2) followed by conversion to liquids. Breakthrough research seeks ways to directly convert methane to liquid. This would significantly reduce capital costs, operating costs and efficiently losses. It could lead to competitive supplemental sources of liquid fuels in the range of $25-$30 per barrel.

Question: For the record, describe the activities and funding for each being carried out in FY 1990 and what follow-on work is contemplated in FY 1991.

Answer: In FY 1990, total funding was $2.7M and in FY 1991 total funding is $1.3M. The following describes the activity:

- At PETC - FY 1990 -$1.1M
  - In-house research on oxyhydrochlorination process developed at PETC ($0.63M)
  - Fundamental research at SNL on direct methane activation ($0.1M).

  - Cost-shared research with AMOCO on the oxyhydrochlorination process ($0.395).

- o At PETC - FY 1991 - $0.52M
  - Continue cost-shared research with AMOCO.
  - Terminate SNL activity.
  - Significantly reduce in-house research.

- o At METC - FY 1990 - $1.6M
  - In-house METC exploratory research on methane conversion to liquids ($0.345M).
  - National Laboratory research at LLNL and LANL on alternative pathways for direct methane conversion to liquids, including the application of metal oxide complexes ($0.494).
  - Cost-shared research with Sun Oil/GRI on a direct air-oxidation process for methane to liquids and fundamental research on conversion mechanisms at Lehigh University ($0.789M).

- o At METC - FY 1991 - $0.78M
  - Terminate in-house and National Laboratory research.
  - Continue cost-shared research on methane to liquid research with industry and universities ($0.78M).

Tar Sands

Question: The NRC study suggests evaluation of technologies for tar sands extraction. Do you agree that this is a potentially low cost source of oil?

Answer: Relative to alternate sources of oil such as oil shale and coal, many U.S. tar sands deposits could yield lower cost oil. This would require that selected existing and new U.S. and Canadian extraction processes be improved, optimized and tailored to the key process/geological characteristics of these deposits. However, the smaller tar sands resource makes it difficult to commit to the extensive development program required for U.S. tar sands conversion.

Question: What is the extent of the resources?

Answer: U.S. tar sands resources are estimated at about 75 billion barrels. This is based upon a 1983 assessment for IOCC with USGS updates reported in 1987. However, according to research done by the University of Utah, this estimate may be low because there is no active exploration for tar sands. The resource is rather diffuse and over 500 underground reservoirs and surface deposits have been identified.

Question: Have you ever done a comprehensive evaluation of tar sands technologies? If so, with what results? If not, what would be the cost to evaluate potential cost reduction technologies and how long would such an evaluation take?

Answer: A comprehensive evaluation of tar sands technologies, similar in scope to the one conducted on EOR technologies and completed by the National Petroleum Council, has not been done. The last report of substance which dealt with "Assessment of International Tar Sands Recovery and Upgrading Processes" was done in August 1981, by Booz Allen and Hamilton, Inc., for the Lawrence Livermore National Laboratory. The report describes the status of development of several production methods used, placing emphasis on Canadian deposits where most of the research and development work on tar sands was started, and continues to this day. The Report also evaluates the effectiveness of several processes in overcoming barriers to commercialization, but no conclusions are drawn.

An updated comprehensive evaluation of tar sands technologies might take about 6 months and would cost approximately $100,000. Such evaluation would not include any field work such as core drilling and reservoir property appraisal.

Question: Is there any industrial interest in this area?

Answer: Yes. Since the recovery in oil prices from the low level of 1986-87, some signs of industry interest in tar sands have emerged. Three small industry groups are reportedly endeavoring to initiate asphalt manufacture. One major oil company has initiated testing of a new surface recovery process with the Western Research Institute (WRI). With respect to in-situ technology, the cost reductions reported in Canada have prompted at least one major oil company to reexamine U.S. recovery options.

Enhanced Oil Recovery

Question: Please briefly describe your recently formulated oil program.

Answer: The new oil program has been revised to reflect critical near-term issues, while maintaining a strong technology base as reflected in the current program. The need for a near-term effort recognizes, the continued decline in domestic oil production, the rate of field abandonment with an associated loss of future opportunity, and the fact that unless access can be maintained, there will be no place to apply results of longer term technology development.

The goal of the program is to maximize economic producibility of domestic oil resources by improving prospects through the removal of technical barriers to production. Strategic objectives included for the near-term to preserve access to reservoirs with a high potential which is rapidly approaching its economic limit; for the mid-term to develop, test, and transfer best, currently defined advanced technologies; and for the long-term to develop sufficient understanding to define new recovery opportunities.

Guiding concepts for the program are to select reservoir classes with the highest potential and urgency and then determine the problems associated with these classes. In the future, field RD&D will be conducted in selected classes. In addition, field work will be supported with targeted R&D that will exploit available synergies, focus tech transfer as part of the process, and incorporate environmental efforts as part of the overall program.

Question: How does it differ from the current program?

Answer: The new oil program differs from the old one in four important ways:

(1) It adopts an entirely different strategy consisting of reservoir classification based on depositional characteristics, diagenesis and techonic histories to exploit similarities and differences among these classes in order to focus research efforts aimed at increasing the ultimate oil recovery efficiency.

(2) It refocuses the oil program to reflect shorter term issues such as the problem of arresting well abandonments and preservation of access to reservoirs with relatively high potential so that improved EOR technologies can still be applied when they become available at a later date.

(3) It emphasizes technology transfer with emphasis on independents who produce significant amounts of oil, but do not conduct research on their own.

(4) It emphasizes the use of R&D consortia, consisting of producers, supporting industries, consultants, universities, and state agencies, as a means to transfer the technology and to assure relevance of the research.

Question: What is the industry's general reaction to it?

Answer: The new oil implementation plan was widely circulated for comments to industry, research institutions, academia and State geologists. Comments received to date indicate strong approval of the DOE's increased emphasis on near-term objectives. Generally, larger producers are more neutral, and smaller operators more positive. Other institutions generally supported the new program. Many provided valuable comments which were incorporated into the final version of the implementation plan.

Question: At what stage are you in determining what classes of resources you will investigate?

Answer: A meeting was held during April 3-4 in Dallas, TX, for the purpose of selecting the national reservoir classification system to be used. The expected schedule for classifying the reservoirs is: 50% of the reservoirs in the DOE's Tertiary Oil Recovery Information System (TORIS) to be classified my May, 1990, and 9 major oil producing States' reservoirs to be classified by October, 1990. Our intention is to identify the first 2 classes by late summer 1990 and to hold the problem definition meeting in August and September 1990.

Question: Will the plan include heavy oil and offshore oil areas also?

Answer: Yes. The TORIS system presently contains mostly light oil reservoirs. The data on heavy oil and offshore resources will be added and the full U.S. oil resource, including heavy oil and offshore resources is scheduled for completion in October, 1992.

Question: Once classes are identified, what occurs next in the process?

Answer: Once the classes are identified, the next step will be to hold class and meetings and workshops to identify problems generic to each class. Results of these meetings will be published and become a source document for dialogue between DOE, the States and industry to determine the most rational steps, E.G., in preserving access. The meetings are expected to identify both the technology to be transferred and the target audience.

Question: Of the 1991 budget, what portion will be directly part of the new program strategy?

Answer: The 1991 budget request in support of the new program strategy is as follows:

Major Work Categories	($ in thousands)
Analysis and Planning	3,644
Field R&D	11,945
Supporting R&D	10,060
Not Associated with Plans	1,456
Total for FY 1991	27,105

Question: What specific activities will be undertaken in 1991?

Answer: Two new initiatives are included in the FY 1991 request, 1) begin efforts to establish environmental requirements in both heavy and light oil and. 2) begin efforts in the first two highest priority classes to provide technology transfer in the near-term and actual field work in the mid-term timeframe. Specific supporting research requirements are unknown at this time but will be defined during the first two class meetings. Industry proposals will have a strong influence in deciding which class is started first.

Question: How long will it take to adjust the program to its new strategy?

Answer: The program plan, as developed, reflects efforts begun in FY 1989 to classify the Nation's reservoirs in three oil producing States. That work is now in its second phase which is to classify reservoirs in seven additional States. This, in turn, will lead to the next logical task which is to identify the first two priority classes this summer and then to meet with operators and others to define the problems associated with the two priority classes. It is expected that problem definition will be completed for 80-90% of the domestic resource by October, 1990. The program will be evolving throughout this period in response to the identified problems.

Question: Please explain the part that potential well abandonment plays in the plan, and how you intend to address it.

Answer: As reservoir classes are identified, individual class members will be evaluated to estimate: (1) production potential based on existing and (defined) advanced extraction processes and (2) probability of abandonment based on a decline curve analysis. Classes will be prioritized based on future production potential and urgency based on risk of abandonment. Reservoir class meetings, covering the full geographical area of the class, will be held for the highest priority classes. These meetings with industry and others will lead to: the identification of currently available processes that have the potential for extending the economic life of high risk wells; the most appropriate actions for encouraging wider adoption of these processes; and the target audience.

Question: Is there any research, either on-going or contemplated, on techniques to make it more economic to re-enter wells that have been abandoned?

Answer: We are not aware of any research on re-entering abandoned wells. Re-entering of abandoned wells is not a constraint to field operations at this time. The low oil price prevents these marginal oil wells for continued production, i.e., cost of oil pumping, oil transport and repair of equipment may be more than the value of the low oil production. Our program, however, seeks to delay or prevent the abandonment of reservoirs with high potential for future production through expanded application of best available production technology.

Question: Is this a high priority?

Answer: Preserving economic access to reservoirs with significant future production potential is very important. Reentry to abandoned fields with large future potential may be important if future technology development would justify the effort and expense of such action. In general, however, new wells would be preferable to re-entering cemented wells. The first choice is to prevent abandonment in the first place; use of economically reversible plugging is a fall back position, although development of economically reversible plugging is a relatively high priority.

Question: How likely is it that such research will be successful?

Answer: Based upon the best currently available information which encompasses about 40% of the target oil, broader application of proven techniques such as mobility control and profile modification has a high probability of successfully moderating abandonments. Research on economically reversible plugging, whose use in the field would be a fall back option only, appears to also have a high probability of success.

Question: Can you identify research in the current (FY 1990) program that should be phased out or deemphasized in the future based on the new plan? If so, please describe these areas in some detail in the record.

Answer: We will not be able to identify research in the FY 1990 program that should be phases out until after we have identified the highest priority classes and the problems associated with them. However, we expect that the program will naturally evolve from a generic to more target oriented research.

Question: At what stage will field work in the various reservoir classes begin?

Answer: Field work in the various reservoir classes begins with class and site specific reservoir architecture description, leading to identification of the critical parameters affecting fluid flow. That is to be followed by simulation design and evaluation which, if successful, would lead to actual field demonstration projects.

Question: What is your estimate of the annual cost of this program plan and when would the highest priority classes be complete?

Answer: Total cost, assuming actual field work in 10 classes is estimated to be about $600 million over a 15 year period, or an average of $40 million per year. Actual annual costs will depend on the number of classes selected and the rate at which those classes will be addresses. The first two classes proposed for FY 1991 are scheduled for completion in September, 1997.

Question: Please explain how you intend to manage and contract for the program?

Answer: We anticipate that each class will be assigned a project manager responsible for all phases of work within that class. All procurements are expected to be competitive.

Question: What would be the dollar magnitude of a contract for each resource class?

Answer: Based on the best information available to date, total Federal costs per class are estimated at $32 million. Actual costs cannot be determined until the problems have been identified.

Question: What level of cost-sharing would you expect from this approach?

Answer: We will attempt to achieve maximum practical level of cost participation at all work levels. Actual field tests are expected to be at least 50% cost-shared by the private sector.

State Programs

Question: What progress are you making in establishing a Federal-State cooperative program as directed by the conference report on the 1990 Appropriation?

	Annex M: Fluidized Bed Combustion, Gasification, Waste Management, and Gas Stream Cleanup	$945	$0
	Annex P: Coal Preparation and Advanced Combustion	$555	$0
INDIANA	Annex 1: Shale Oil-Modified Asphaltic Paving Materials Feasibility Study	$417	$615
KANSAS	Annex 1: Depositional Sequence Analysis and Sedimentologic Modeling for Improved Prediction of Pennsylvanian Reservoir	$172	$193
KENTUCKY	Annex 1: Barriers to the use of Atmospheric Fluidized Bed Combustion in Kentucky	$4	$0
LOUISIANA	Annex 1: Development of Improved Methods for Locating Large Areas of Bypassed Oil	$260	$0
NEW MEXICO	Annex 2: Fluid Diversion and Sweep Improvement with Chemical Gels in Oil Recovery Processes	$140	$147
TEXAS	Annex 1: Characterization of Oil and Gas Reservoir Heterogeneity	$235	$0
	Annex 3: Field Laboratory for Improved Oil Recovery	$200	$0
	Annex 4: Oil Recovery Enhancement from Fractured, Low Permeability Reservoirs	$255	$214
	Annex 5: Microbial Enhanced Oil Recovery	$100	$0
	Annex 6: Development of Nuclear Magnetic Resonance Imaging/Spectroscopy for Improved Petroleum Recovery	$310	$335
WYOMING	Annex 1: Waste Stream Characterization Waste Stream Minimization and Waste Water Disposal Studies Applicable to the Processing of Western Coals	$1,750	$0
	TOTALS	$6,833	$2,839

Answer: Information relating to a Federal-State cooperative program has been obtained from outside agencies, and a revamped program description has been developed and circulated for public comment. These comments are due April 30. In addition, meetings with State governors have been scheduled for early May to fully explain the revamped program and to obtain their comments and suggestions.

Question: What level of support is included in the 1991 budget for programs already established in FY 1990?

Answer: The Office of Fossil Energy will honor all agreements already established in FY 1990. The commitment for FY 1991 is $2,838,652.

Question: Please provide the details of funding for each agreement for 1990 and 1991 for the record.

Answer: Details for funding for all agreements for 1990 and 1991 are hereby provided for the record.

DOE/STATE COOPERATIVE PROGRAM
FUNDING INFORMATION
FOR FY 1990 AND FY 1991

		-----DOE FUNDING----- (In Thousands)	
STATE	TITLE	FY 1990	FY 1991
ALABAMA	Annex 1: Establishment of Oil & Gas Data Base for Increased Recovery Characterization of Oil and Gas Carbonate Reservoir Heterogeneity	$215	$200
	Annex 2: Characterization of Sandstone Heterogeneity in Carboniferous Reservoirs for Increased Recovery of Oil and Gas from Foreland Basins	$340	$280
ALASKA	Annex 4: Development of Gas Hydrate Resources	$85	$0
	Annex 7: Characterization of Oil and Gas Reservoir Heterogeneity	$195	$195
ILLINOIS	Annex 1: Improved and Enhanced Oil Recovery through Reservoir Characterization	$655	$660

Question: Do you expect the State cooperative program to be part of the new overall oil program plan or separate from it?

Answer: The new State cooperative program is not separate from the new overall oil program plan; it rather will be driven by the National Energy Strategy and established oil, gas and coal programs.

Question: Have you included any funds in either the oil or the gas program to implement this concept? If so, please identify them. If not, what levels of support do you think would be adequate for a viable program?

Answer: No specific funding has been included in the oil and gas program to implement this concept, however, we are in the process of determining the amount required to implement a viable program.

Question: Do you expect to be able to get at least 50 percent cost-sharing from the States?

Answer: All agreements in the previous State cooperative program were cost-shared agreements, with the States' share ranging from 50 percent to a total of 88 percent. Based on this prior experience, cost-sharing support from the States should continue to be at least 50 percent in the new State cooperative program.

Advanced Extraction and Process Technology (AEPT)

Question: How much of the fundamental geoscience research program in FY 1990 was for the "University Geoscience Research" program separately identified in 1991? (p. 83-89)

Answer: Of the $2,800,000 appropriated in FY 1990 for the Fundamental Geoscience Research program, the "University Geoscience" program received $1,300,000. These funds were used to support the second year of ten contracts awarded under a PRDA initiated in FY 1989. In FY 1991, the $1,300,000 requested under the University Geoscience Research line item is for the continuation of this program.

Question: What makes the $3,000,000 jointly funded geotechnology research program in 1991 difference than the other research currently underway? (p. 83)

Answer: The difference is that, the $3.0M is for advanced geotechnology research in support of the Oil Research Plan (ORP). It is a portion of the total ORP Supporting Research category. The difference is that, the focus of this jointly funded program addresses the highest priority crosscutting advanced research specific to highest priority reservoir classes identified during implementation of the ORP.

In comparison, the geotechnology research currently underway in the AEPT program focuses on high priority fundamental topics which crosscut all reservoir types. The research is oriented toward (1) exploring untried concepts that are unusual, novel and highly innovative, but with a very high potential payoff and (2) developing tools, techniques, understanding, and theoretical knowledge that is broadly applicable to oil recovery technologies.

Question: How much of the AEPT program in 1991 is tied directly to the new oil research plan?

Answer: The portion of this program which is tied directly to the new oil research plan is the $3.0M which is separately identified in the key activity summary.

Enhanced Oil Recovery

Question: How much in total do you expect to spend in 1991 on the so-called "extension service" concept? (p. 88 and 91)

Answer: The total amount of funding planned for the "extension service" concepts in EOR is $370,000 ($250,000 in the heavy oil program and $120,000 in the light oil program).

Question: Why is this activity necessary?

Answer: The main purpose of the extension service concept is to increase the transfer of critical data and technology to the private sector, particularly to independents who produce a significant amount of oil but do not conduct their own research and need outside help in this vital area.

Question: Will fossil energy manpower allocations be made to this program? If so, from what component, and how many people?

Answer: No additional FE staff will be required to run this program. The interested States will provide the necessary manpower to run the extension service program.

We anticipate that FE manpower will be used to monitor projects with the States but the States will run the extension service.

Question: If you intend to have comprehensive meetings on the major classes of resources as part of your new oil strategy, why do you also need the "extension service"?

Answer: The meetings on the major classes of resources are for quite different purposes than the extension service concept. These meetings will be held in conjunction with the establishment of a national reservoir classification scheme based on geological history and on the identification of reservoir classes that have the greatest potential for additional oil recovery and yet present highest risk of early abandonment. Research, development, and demonstration will then focus on the highest priority reservoir classes, based on analysis of the entire U.S. resource.

A number of meetings are planned with attendance by operators, large and small, as well as researchers familiar with a particular class. The meetings will not be for the purpose of technology transfer, which is the primary purpose of the extension service project, but rather for the purpose of defining problems associated with each class, so that detailed program plans and procurements can be based on these identified problems that are characteristic of each reservoir class.

Question: With whom is the cost-shared field test of alkaline technology in heavy oil contemplated? (p. 88) Why?

Answer: It is not yet known who will conduct the alkaline field test in heavy oil recovery; however, discussions are on-going with two potential participants in the test.

Alkaline flooding has proven to be an effective recovery mechanism in laboratory tests which needs to be tested under field conditions. The results could also be applicable to the full spectrum of oil recovery.

Question: In light oil, how much of the research is to support programs begun with competitive procurements in 1989 and 1990?

Answer: The geoscience PRDA issued in FY 1989 and awarded in FY 1990 has a mortgage of $2,157,000 for FY 1991. Another geoscience RFP issued in FY 1990 for $1,477,000 will be awarded with funds carried over from FY 1990 in FY 1991.

Question: Explain why microbial recovery and CO2 recovery projects are expected to decrease in 1991. (p. 90-91)

Answer: Both microbial EOR and CO2 recovery research are funded at a lower level in FY 1991 due to project completions and budget restrictions that necessitated requesting funds for other higher priority projects within the EOR program.

In microbial EOR, funding of three current field projects will be completed in FY 1990, although the results will not be available until FY 1991. The three tests are at the Delaware-Childers field; University of Oklahoma/Mesa Limited Partnership at Vasar field; and Alpha Environmental at NPR #3.

In CO2 flooding, the steady stream of new starts of CO2 projects and steadily increasing oil production from CO2 flooding attests to the commercialization of the technology and decreased necessity of Government funding.

Question: Are there projects that will not be completed? If so, explain why and how much they would cost to complete.

Answer: The only project that will not be completed in FY 1991 is the Idaho National Engineering Laboratory MEOR research project. That project would require about $3.0 million to complete, part of which would consist of an MEOR field test. The other projects would be completed in FY 1990, as indicated in the previous question.

Question: Describe the structure of the "Oil Recovery Technology Partnership", what results it has had, and the proposed funding for fiscal years 1989, 1990, and 1991. (p. 91)

Answer: The Oil Recovery Technology Partnership is co-chaired by Los Alamos National Laboratory (LANL) and Sandia National Laboratories. It is supported by a Partnership Steering Committee and an Industry Review Panel to insure industry guidance and support in geotomography. The Partnership formed the Cross-well Seismic Forum, which consists of more than 20 industrial participants. These participants cooperate in the development of cross-borehole seismic tomography. Funds for the Oil Recovery Technology Partnership include: $1.0 million in FY 1989; approximately $1.0 million in FY 1990, and $1.8 million in FY 1991.

Question: What is the status of the Improved Gravity Drainage project?

Answer: The Contracting Office at the Pittsburgh Energy Technology Center has notified IGD that funding for the project would not be continued past March 31, 1990.

Question: What funding is included in 1990 and 1991 for the project?

Answer: The funding for the IGD project in FY 1990 is $2,807,000. The FY 1991 request is $900,000. However, the Department has informed IGD that funding for the project would not be continued past March 31, 1990. All uncosted funds will be proposed for reprogramming to other areas within EOR.

Question: What is your assessment of horizontal drilling technology?

Answer: Horizontal drilling technology is generally considered commercial for oil applications and is mostly used by major oil companies. Sharp increase of interest and actual horizontal drilling activity was observed during the last 2 years. The future of horizontal drilling is very promising, with some estimates that by the year 2000, as much as 50% of all development oil wells in the U.S. will utilize horizontal drilling technology.

Little horizontal well technology has been applied to gas reservoirs. DOE presently has a program testing this technology in the marginally economic eastern gas shales and western tight gas resources. Research in increasing gas production from these resources has had limited success to-date. Horizontal drilling offers great promise in overcoming many of the problems identified to date such as formation damage and the fractured nature of the reservoir. Research associated with DOE's horizontal drilling effort include both stimulation and well cost reduction research (air-drilled wells).

Question: Is the current drilling technology sufficient to be commercially viable?

Answer: Yes, in general, the current drilling technology is sufficient to be commercially viable for oil applications.

A feature article in the February 26, 1990, issue of the Oil and Gas Journal states that "this technology is receiving worldwide acceptance and the number of wells drilled continue to accelerate rapidly."

The survey listed 130 horizontal wells with horizontal laterals exceeding 1,000 feet and these were only a part of all the horizontal wells drilled in 1989. Wells with shorter lateral reach were generally excluded from the survey and some companies did not respond to the survey.

Another comprehensive article on horizontal drilling appeared in the Petroleum Engineer International, November 1989, with generally the same conclusions.

Question: Is knowledge of the specific oil or gas field structure and geotechnical characteristics a more important factor in determining whether horizontal drilling is successful or is the drilling technology?

Answer: Knowledge of the specific oil and gas structure and reservoir heterogeneities are more important in determining the success of horizontal drilling.

Some examples include those reservoirs with an overlying gas cap or an underlying aquifer--a vertical well will soon result in "cusping" of gas from the top or "coning" of water from the bottom, causing very inefficient oil recovery. A horizontal section through the oil column will result in a much higher oil recovery efficiency.

Another example is drilling in very low permeability reservoirs that are fractured, generally in one direction. A single horizontal well drilled to intersect many of those factures will result in much higher productivity than a vertical well, which may not intersect any fractures at all.

Also, depending on reservoir stratification and continuity, horizontal drilling may be used to produce from several areas where each area would require a single vertical well.

Question: Might demonstrations of horizontal drilling be tied to field tests of resource classes in the new oil program strategy?

Answer: Yes, demonstrations of horizontal drilling could possibly be tied to field tests of resource classes.

For example, if one of those classes consists of very low permeability formations such as the Austin Chalk or the diatomaceous oil fields of California that exhibit directional properties, e.g., extensive vertical fracturing with unidirectional orientation, then horizontal wells drilled perpendicular to those fractures could maximize oil recovery.

Question: Is there technology development in horizontal drilling that you believe it is necessary for fossil energy to support? If so, explain why.

Answer: The application of horizontal drilling under unusual conditions of reservoir structure, reservoir heterogeneity or variation of EOR schemes would seem more appropriate for Fossil Energy's support than the technology development in horizontal drilling. As indicated earlier, the horizontal drilling technology is already available and widely used by many operators and drilling contractors.

Technology development is part of the Gas program's horizontal testing effort in eastern gas shales. Work is underway to reduce costs in both the drilling and completion phases of air-drilled horizontal wells.

Industry to-date has not shown an interest in developing this technology on their own. Air-drilling is most commonly used in the northeast region of the country.

Question: Are there funds requested in the 1991 budget for oil or gas for horizontal drilling? If so, where?

Answer: Funds in the amount of $2,117,000 are requested in the FY 1991 gas budget for testing the application of horizontal drilling in tight gas resources. These include $1,165,000 for Eastern Gas Shales and $952,000 for Western Tight Gas Sands.

Coal Preparation

Question: Please describe the status of your acid rain initiative in coal preparation.

Answer: The coal preparation acid rain initiative is proceeding on schedule for completion by the end of calendar year 1992. The coal surface control projects have completed initial research phases including effects of coal weathering. Southern Company Services has completed bench scale testing of its selective agglomeration process (which uses Heptane as its agglomerating agent) and is proceeding to construction of a 2-3 ton/hour unit. Kaiser Engineers is conducting bench scale tests of its advanced froth flotation process. Aspen Tech has initiated work on its process flow simulator which will be used as an aid to design a commercial scale advanced physical coal cleaning plant.

Question: Is funding sufficient to complete this initiative by 1992 as planned?

Answer: The funding appropriated in FY 1990 and requested for FY 1991 is sufficient to keep this initiative on schedule.

Question: What additional funds, if any, would be needed in 1992?

Answer: An additional $4 million will be needed in FY 1992.

Question: Do you have any indications that, if this technology is demonstrated successfully, it will be used by coal suppliers or utilities to abate acid rain?

Answer: Yes. Internal DOE analyses show the selective agglomeration process to be economically attractive. The Electric Power Research Institute (EPRI) and Southern Company Services have shown considerable interest in and commitment to the process. They are also cost-sharing the project.

Question: Are any coal preparation technologies being used in clean coal technology procurements to date?

Answer: The following coal preparation technologies are being demonstrated under the Clean Coal program:

1. Otisca Industries, Inc. - selective agglomeration (which uses pentane as its agglomerating agent with ultra fine coals)

2. Western Energy Co. - advanced drying technique for Western coal

3. Combustion Engineering - combustion testing of conventionally cleaned coals from EPRI's Homer City Facility

Question: After completion of the acid rain initiative, what coal cleaning activities related to direct combustion in boilers do you intend to pursue?

Answer: The primary thrust of the Coal Preparation Program after completion of the acid rain initiative will be development of super clean coal-based fuels to displace premium fuels. The primary market for these fuels will be utility and industrial boilers, as well as commercial, residential, and heat engine applications.

Question: There is no budget support for projects at the EPRI coal cleaning facility after FY 1990. Are there additional projects worth pursuing?

Answer: We believe there are additional projects worth pursuing, and in FY 1990, $2.0 million was provided to support projects at the EPRI coal cleaning facility. An RFP is scheduled for FY 1990 for advanced physical concepts tests at this facility. It is anticipated that the $2.0 million will be sufficient to test one process through FY 1991.

Question: What processes have already been tested there, and with what results?

Answer: Testing of Bechtel's microbubble flotation process was completed in 1988. This process achieved significant sulfur reduction but failed to achieve the ash reduction objective. Process Technology's heavy liquid cycloning process testing was completed in 1989. Technical problems prevented achieving continuous runs of the proof-of-concept scale unit. Testing of Bechtel's selective agglomeration unit was completed in March 1990. Preliminary results indicate ash and sulfur reduction objectives were met. Analyses of the run data are continuing.

Question: What is the status of technologies being developed for cleaning coal for use as a base for an alternative fuel?

Answer: Physical, chemical, and microbial coal cleaning processes can all produce products that can serve as a base for an alternative fuel. Microbial technologies have great economic and performance promise but are at early development states. Chemical cleaning is currently at the bench scale research stage. The Gravimelt process will be tested in FY 1990 in a continuous, integrated system mode at bench scale. Physical coal cleaning processes are the most advanced, but are not capable of cleaning coals to the same level as the previous two. Physical processes are undergoing proof-of-concept testing at EPRI's Homer City Facility and one (Otisca) is being demonstrated under the Clean Coal program.

Question: Are these processes often the same as those for direct firing in boilers?

Answer: In general, processes for producing alternative fuels are considered suitable for producing boiler fuel.

Question: What results have been gotten from the Gravimelt coal cleaning process?

Answer: The Gravimelt system has shown the capability to remove more than 90% of both total sulfur and ash in batch and continuous tests. In the continuous testing conducted in FY 1989, technical problems prevented full integration of the system. Negotiations are currently underway for additional testing in fully integrated operation under the existing contract with TRW.

Question: To what uses could this fuel be put?

Answer: Potential markets for the cleaned coal could include residential heating units, commercial and small industrial boilers, utility/industrial boilers, and heat engines.

Question: Is there any indication that such a process can be economical? If so, in what kind of applications?

Answer: An economic analyses projects product cost at $3.00 to $4.00 per million Btu. At the $3.00 to $4.00 level, Gravimelt fuel should be competitive in many residential, small industrial/commercial boiler and heat engine applications.

Question: What is the status of biological processes for cleaning coal?

Answer: Microbial cleaning is a very promising but long range approach. Major technical hurdles remain (e.g., current process reaction rates are slow and the microbes are fragile). Bench scale research has been undertaken in the areas of organic sulfur active microbe identification and enhancement, enzymatic sulfur removal, molecular biodesulfurization, and verification of the 4S pathway mechanism for removing organic sulfur from coal.

Question: Who is doing the work in this area? With what results?

Answer: The following projects are now active in this area:

1. Louisiana Tech University - Microbes capable of removing organic sulfur have been identified.
2. Holometrix - Work is proceeding on testing enzymatic removal of organic sulfur.
3. Institute of Gas Technology - The effectiveness of organic sulfur active microbes has been enhanced.
4. UNDEERC - Work is ongoing in the area of molecular biodesulfurization.
5. Lehigh University - Positive results have been obtained in the area of cloning and genetic expression for sulfur removing microbes.
6. Battelle - Work is proceeding on molecular enhancement of coal biodesulfurization.

Question: What is the funding in FY 1990 and FY 1991?

Answer: FY 1990 funding is $862,000. FY 1991 funding is $260,000.

Flue Gas Cleanup

Question: On an overall basis, is this program likely to contribute to the technologies used to comply with clean air legislation? If so, explain how.

Answer: Yes, by providing lower cost, more energy efficient technologies than currently available for reducing SO_2 and NO_x and meeting the Clean Air Act (CAA) emission limits. The technologies will be developed by FY 1992. They are candidates for demonstration and subsequent deployment under the Clean Coal program (CCT). Some technologies, like NOXSO, are already part of CCT. Other technologies, such as the copper oxide process, may be proposed in the next CCT round.

In addition, high percentage (95-99%) SO_2 capture technologies can provide the required emission offsets or allowances required under the CAA emissions cap for capacity additions beyond the year 2000. These technologies are presently at very early development stages.

Question: What is the status of your acid rain control retrofit program?

Answer: Three duct injection proof-of-concept (POC) projects initiated in FY 1985 were completed in FY 1989. In FY 1988, 3 Requests for Proposals (RFP) were issued to address problem areas indicated by the 3 POC projects. These RFPs resulted in the following awards:

- o Duct/ESP Phenomena - Radian Corporation - Experimental testing began in August 1989 and will be completed by mid FY 1991.
- o Scaleup Tests - Gilbert Commonwealth Inc. - Design of modifications to the existing DOE 12 MW duct injection test unit at the Muskingham River Station of Ohio Power in Beverly, Ohio, have been completed. Construction is underway.
- o Duct Injection Prototype Development - United Engineers and Constructors - This project serves as a bridge between process development work and commercial implementation. Two technology transfer meetings have been held to date and a monthly newsletter is published and distributed to the technical community.

Question: Will it be completed by 1992 as planned?

Answer: Yes, it will be completed by the end of 1992.

Question: What costs will be required, if any, in 1992?

Answer: In FY 1992, $565,000 will be needed to complete work in this program area including $200,000 for the EPRI Hisulfur Test Center, and $365,000 to complete the duct injection integrated studies now underway (Gilbert Commonwealth, UEC).

Question: What indications do you have that duct injection will be used in acid rain control?

Answer: Preliminary studies indicate that duct injection technology can be a very cost effective component in overall approaches to meet both the 2.5 and 1.2 lbs. SO_2/MMBtu requirements of the proposed acid rain control legislation. We are further encouraged by the submission of duct injection technology projects in response to the CCT III solicitation.

Question: Are there clean coal technology procurements using this technology?

Answer: This technology is employed in the Babcock & Wilcox LIMB Extension Project (Coolside Process) and the EER Gas Reburning/Sorbent Injection Project (SO_2 control for cyclone boiler) selected under CCT-I. Under CCT-III, the Bechtel Confined Zone Dispersion Project was selected along with the Public Service of Colorado Integrated Dry NO_x/SO_2 Emission Control System project.

Question: How does the TUNG process related to this initiative and what is its status?

Answer: The TUNG process is intended to achieve a much higher sulfur removal efficiency (90%) than duct injection. It will, therefore, be applicable to a wider range of coal use, and will address the requirements of Phase II of the proposed Clean Air Act amendments.

After successful bench scale operation, the decision was made by DOE to proceed to Phase II, proof-of-concept (POC) scale-up. A design is currently underway for a TUNG POC unit to be installed at Niagara Mohawk's Dunkirk Plant.

Question: Why is the combined NO_x/SO_x control program being reduced drastically?

Answer: The funding requested for these projects was reduced in line with the program requirements resulting from project completions and research efforts proceeding to proof-of-concept.

Question: Are there no promising processes in this area?

Answer: Projects in this area include the UOP copper oxide process, the NOXSO process by M-K Ferguson, and the Cottrell integrated dry injection project. All three are considered promising.

Question: Are existing projects being slowed or discontinued?

Answer: No projects have been discontinued. While some have been "stretched out", no delay in the achievement of the overall objective is anticipated.

Question: Does pending acid rain legislation affect this program at all?

Answer: Yes, the provisions of the proposed amendments which allow the substitution of NO_x removal to achieve so_2 compliance can make combined SO_2/NO_x processes more attractive than processes that control only SO_2.

Question: Why is the NO_x reduction program being reduced?

Answer: The FY 1991 budget request is reduced due to the $2,077,000 in FY 1990 and prior year funds available for projects scheduled for award at the end of FY 1990.

Question: Does pending acid rain legislation affect this program?

Answer: Yes. The provisions of the amendment which "cap" NO_x emissions as well as the substitution of NO_x for SO_2 to achieve compliance make this technology potentially more attractive.

Question: Are there promising concepts to pursue?

Answer: Yes. Potentially attractive concepts include the "Argonox" process being developed by Argonne National Laboratory, the Yellow Phosphorus Process being developed by Lawrence Berkeley Laboratory, advanced natural gas reburning, and selective catalytic reduction technology using a baghouse coated with a catalyst.

Question: Please describe the status and potential of the following technologies for the record, and what further activity fossil energy is undertaking on them. The "ARGONOX" process developed by Argonne National Laboratory. A process adding yellow phosphorus to a conventional scrubber to capture NO_x, developed by Lawrence Berkeley Laboratory.

Answer: The "Argonox" process in an outgrowth of DOE funding work at ANL in screening chelating agents. It promises to provide NO_x removal, in retrofit applications of 50% to 90% depending on the specific scrubber being used. Dravo Lime has submitted a proposal under the Advanced NO_x Control RFP to develop this process.

The yellow phosphorus process being developed by Lawrence Berkeley Laboratory is now in the bench scale phase. In it, yellow phosphorus is added to the scrubber liquor, which forms ozone, which oxidizes NO to NO_2. This process offers the potential of 90% NO_x removal. There are some safety concerns with respect to handling phosphorus. A safety analysis will be conducted by PETC.

Gas Stream Cleanup

Question: What is your assessment of the importance of these technologies to gasification processes, pressurized fluidized beds, and direct coal-fired turbines?

Answer: The development of hot gas cleanup technology is critical for the commercialization of advanced power systems such as integrated gasification combined cycle (IGCC), pressurized fluidized bed combustion (PFBC), and direct coal-fired turbine (DCFT) systems. The incorporation of hot gas cleanup technology into these systems will simplify their designs, improve their efficiencies, and reduce their system costs. These technologies also are in direct support of Clean Coal Technology demonstrations. Without the successful development of high temperature methods for sulfur and particulate control, the commercialization of these advanced systems is doubtful.

Question: What is the status of the joint DOE/industry particle test facility?

Answer: The cooperative agreement between the Department of Energy and Southern Company Services to design, construct, and operate a hot gas cleanup test facility for gasification and pressurized combustion at Wilsonville, Alabama, is currently in the pre-negotiation stage. Approval of a cooperative agreement is scheduled by May 1990.

Question: Are any funds contained in the 1991 budget for this facility?

Answer: The FY 1991 budget request contains $500,000 for the joint DOE/industry hot particle test facility.

Question: On what schedule will the budget allow the facility to move ahead?

Answer: The conceptual and detailed design of the facility is scheduled to cover a 24-month period. During this period, identification and procurement of long-lead items must be accomplished if the sufficient 12-month installation schedule is to be maintained. Funding of $500,000 could delay project completion by up to a year.

Question: Would additional funding in 1991 accelerate the schedule for the facility? Please provide details for the record

Answer: Additional funding of $6 million would allow maintaining the current 5-year project schedule. The conceptual and detailed design of the facility is scheduled to cover a 24-month period. During this period, identification and procurement of long-lead items must be accomplished if the subsequent 12-month installation schedule is to be maintained. The operation phase will cover the final 24-months of the 5-year schedule.

Question: Is the previously anticipated industrial cost-sharing expected to be provided? To what extent?

Answer: The previously anticipated industrial cost share of 20% as stipulated in the FY 1990 appropriation for this project is expected to be provided. Based on the current total cost estimate of $46.2 million for this project, the 20% cost share for the industrial participants will be $9.24 million. The proposer must definitize the 20% cost share before approval of each phase by DOE.

Question: How does this facility relate to gas cleanup facilities being constructed at Morgantown Energy Technology Center?

Answer: The Wilsonville DOE/industry gas cleanup facility will be a versatile "dirty gas" producer capable of operation in a combustion or gasification mode on a proof-of-concept scale. The facility will have the capability of testing a wide variety of coals at widely varying gas stream characteristics, including particulates loadings. It will be designed to permit parameters evaluations of particulate removal devices for design changes or resolution of engineering issues. The METC gasifier test facility will be of smaller size and of different design than the Wilsonville facility. The METC gasifier facility is focused on gasification component development and testing of developmental chemical cleanup devices.

Question: How is this facility different than the facility to be located at the TIDD pressurized fluidized-bed plant?

Answer: The Wilsonville DOE/industry gas cleanup test facility will be considerable different from the gas slipstream facility to be located at the TIDD plant. The Wilsonville facility will focus on parametric tests to resolve engineering issues, while the TIDD facility is aimed at long-term testing of a particular design to address durability and reliability questions. The Wilsonville facility will have a dirty gas generator instead of the pressurized fluidized-bed combustor at the TIDD plant. The Wilsonville facility is capable of operation in either a combustion or gasification mode, and can deliver a widely varying solids loading to particulates removal test devices. The TIDD facility does not have the capability of operating in a coal gasification mode, is intended only for particulates removal testing, and has only one location (between the first- and second-stage cyclone) where testing can take place which will result in mostly fixed solids loadings going to test devices. On the other hand, the TIDD facility has a much greater dirty gas throughput than the Wilsonville facility (7700 ACFM vs. 1200-1500 ACFM), which will allow use of larger-scale particulate test devices than for the Wilsonville facility. The latter is needed to qualify advanced particulate capture systems for the American Electric Power's Sporn Plant and other applications.

Question: To what extent would particle capture test devices developed in one facility be applicable to the other technology?

Answer: It is not expected that particle capture devices will be developed at the TIDD gas slipstream facility. The Wilsonville DOE/industry gas cleanup facility will be more flexible and more directed at parametric testing to resolve engineering design problems. The TIDD facility is intended as a long-term demonstration site to prove particulate removal devices that are already under development. Particulate removal devices for gasification use would be applicable at the Wilsonville facility when operated under reducing conditions.

Pressurized Fluidized Beds

Question: What is the status of the particulate test facility at the TIDD plant?

Answer: A cooperative agreement was signed on August 2, 1989, with American Electric Power Service Corporation (AEPSC) for use of the TIDD PFBC Facility to evaluate high temperature, high pressure particulate removal technologies. In FY 1989 $2.0 million was appropriated for design of the TIDD hot gas cleanup facility; the design work will continue through FY 1990. Construction is scheduled to begin in March 1991 with a completion date of December 1992. FY 1990 funding totals approximately $5.9 million and will be used to initiate procurement for facility equipment in preparation for the construction phase of this project.

The proposed program would test one particulate removal technology between January 1993 and December 1994.

Question: How many devices are candidates for testing at that facility?

Answer: Candidate cleanup technologies for testing in this facility include the ceramic candle filter, ceramic cross flow filter, and screenless granular bed technology.

Question: How many devices can be tested with the 1991 budget?

Answer: We have requested $1.4 million in FY 1991 to begin construction of the facility. This funding schedule will allow for the testing of only one device at a time, starting in early 1993.

Question: Why wouldn't it be a good idea to test more than one?

Answer: The testing of more than one device at a time would increase expenditures. We believe that scheduling one device at a time is appropriate given overall program priorities and budgetary constraints.

Question: How much would it cost to test two?

Answer: Additional funding of $4.5 million would be required to test two particulate cleanup devices simultaneously and maintain the current test schedule.

Question: When will devices be able to be tested?

Answer: Testing is scheduled to begin in early 1993.

Question: Will results from these tests be able to be used by American Electric Power in the Sporn Plant from the Clean Coal Technology Program?

Answer: Yes, the hot gas cleanup test program at the American Electric Power Service Corporation (AEPSC) TIDD PFBC facility represents an opportunity to test and confirm integrated engineering design of particle control technologies. The hot particle filter test program will be conducted using a 1/7 flow slipstream at the TIDD PFBC facility. This size was selected since it is envisioned to be about the same size as one of the 21 streams for the AEPSC commercial scale Philip Sporn Plant (350 MWe). A successful cleanup test program at TIDD could lead to the use at the Philip Sporn Plant.

Gas Stream Cleanup

Question: Are you constructing, or are there already facilities to test devices for particulate cleanup for direct-fired coal turbines? If so, describe them and their location.

Answer: There are presently three existing facilities for testing particulate cleanup devices for direct coal-fired gas turbines (DCFT): at Westinghouse (for testing cross-flow filters), MTCI/Penn State (for testing acoustic agglomeration and sulfur capture), and Research Cottrell (for testing electrostatic agglomeration for gas turbines). All of these are bench-scale facilities, and utilize a simulated hot gas. METC is also constructing a flexible DCFT combustion test facility capable of operating at up to 30 atmospheres pressure and 3600°F. The METC facility will be of larger scale than the three existing industry-based facilities, and will use actual hot gas instead of simulated hot gas for testing cleanup devices. Completion of the METC DCFT combustor test facility is presently scheduled for early FY 1991.

Question: How closely related to this overall cleanup work is the cleanup work done in the coal gasification program?

Answer: The overall gas stream cleanup work is broken into five major sections. The section which covers integrated gasification combined cycle (IGCC) is closely related to the cleanup work in the Surface Coal Gasification power systems subprogram in many respects, but has a significant difference. The Coal Gasification power systems subprogram is focused on integrated operations and testing in which the gas stream cleanup device is either internal to the gasifier vessel or externally integrated into the gasification system. The Gas Stream Cleanup program, on the other hand, is focused more on the actual development of the specific cleanup device but not specifically addressing system integration and control. The coal gasification work at General Electric and Texaco is a demonstration of integrated gasification/gas stream cleanup technologies on a meaningful scale where scale-up to commercial designs can be considered for the gas stream cleanup devices.

Question: Would it make more sense in terms of clarity to include the cleanup work in coal gasification in this program as well as the TIDD cleanup work from the PFB program?

Answer: No, from a systems development view point, it would be better to do it the other way around. As previously explained, the Gasification power systems subprogram is more intimately involved with the integrated gasification/gas stream cleanup systems end user than the Gas Stream Cleanup program is. This situation will encourage the transfer of technology to private industry in a system application mode rather than as specific components or system parts, since the end user is much more concerned with system compatibility and operational feasibility than the component developer. The same reasoning applies to the TIDD PFB gas stream cleanup work and its relationship to the PFB program.

Question: What is that status of the Calderon program?

Answer: The Calderon program involves the design, construction, and operation of the Calderon gasification/hot gas cleanup process at 24 tons per day PDU scale. The project construction phase is nearing completion with all process vessels now in place and piping and instrumentation scheduled to be completed by late April 1990. The construction phase includes system start-up and shakedown, which is scheduled for completion by May 31, 1990. The operational phase is scheduled to start on June 1, 1990.

Waste Management

Question: Please explain why field monitoring of disposed waste requires increased emphasis in 1991.

Answer: Waste management is critical to the successful deployment of clean coal technologies. Liquid and solid wastes from new technologies need to be characterized and their "geological" properties documented. As wastes from additional technologies become available, additional field testing should be performed.

Question: What work will be done at Clean Coal Program waste sites?

Answer: The work planned covers excavation of the field site disposal cell, filling of the cell with the waste to be monitored, and installation of groundwater monitoring wells upstream and downstream of the disposal cell. Following preparation, groundwater samples will be periodically taken from the upstream and downstream monitoring wells and analyzed to determine any impacts on groundwater quality caused by the presence of the subject waste. In addition, other solid wastes will also be periodically sampled and characterized.

Question: Why isn't this work part of the Clean Coal Program?

Answer: First, the Waste Management Program is not limited to the technologies which are in the Clean Coal Technology (CCT) Program. Second, the Waste Management Program also addresses waste issues which cross-cut technologies and are not project specific. Third, the program looks at waste behavior as a function of different geologic site characteristics. The data from the CCT projects and Waste Management are complementary. When taken together, the data documents waste behavior as a function of technology category and site geology. This is needed to allow subsequent siting of commercial units.

Question: Explain the interest in "mine disposal" and its significance.

Answer: As land for waste disposal becomes difficult to secure, utilities and other users of coal technology, both conventional and clean coal technologies, are considering the option of mine disposal of their solid waste products. If the cost of backhauling the wastes to the mine site is not prohibitive, this can be an attractive option. There is generally no public opposition, and in the case of the alkaline waste from some clean coal technologies, it is projected that the disposal of such waste may prove to be of environmental benefit in the rehabilitation of the mine site upon closing (possible mitigation of acid mine drainage). However, there are environmental issues which need to be addressed before this disposal methodology becomes common practice.

Question: What is the status of the western coal waste water treatment project?

Answer: This project is underway through an Annex to the Memorandum of Understanding with the State of Wyoming. The project host is Energy Brothers Technology located in Gillette, Wyoming. This effort will include characterization of waste water from the K-Fuel coal preparation process, and bench scale research and development on waste water treatment. The project will culminate in the design of a waste water treatment pilot plant.

Atmospheric Fluidized Beds

Question: What will the minimal funding requested in 1991 allow this program to do?

Answer: The $1,237,000 funding request will: 1) continue the advanced concepts phase II, bench-scale studies for multi-solid AFB and Phase III POC for vortexing AFB research efforts; 2) continue the special applications phase III sub-system integration closed cycle AFB efforts, 3) complete phase II of the pulsed AFB project and, 4) complete the feasibility phase of Good Samaritan's hospital waste co-firing project.

Question: Is it your conclusion that this technology is essentially commercial for utility and large industrial applications?

Answer: The AFB technology has won some commercial acceptance for utility and large industrial applications. However, there are some identified technical problems which still need to be addressed. The most significant of these are metal wastage, scale-up to larger sizes, solid waste disposal and possible concerning over nitrous oxide emissions.

Question: How many AFB projects are active in the Clean Coal Technology program?

Answer: There are three AFB projects in the Clean Coal Technology Program. They are a 110 MWe Nucla CFB demonstration project with Colorado-Ute Electric Association at Nucla, Colorado, a 250 MWe Hopkins CFB project with the City of Tallahassee at Tallahassee, Florida, and a 256 MWe Circulating Fluidized Bed repowering project with Southwestern Public Service Company.

Question: What specific work are you proposing to continue in advanced concepts and special applications?

Answer: We proposed to continue Riley-Stoker's multi-solid atmospheric fluidized bed combustion and Donlee's vortexing AFB projects under advanced applications. For special applications, plans are to continue EER's closed cycle AFB, MTCI's pulsed bed AFB and Good Samaritan's co-firing for the hospital waste project.

Question: Are there any promising projects in these areas? If so, are they funded in 1991? If not, what funding would be necessary to continue them?

Answer: Yes, there are promising projects in this area. The projects funded in 1991 are Riley-Stoker's multi-solid AFBC, Donlee's vortexing AFBC and EER's closed-cycle AFBC. The project not funded in 1991 is MTCI's pulsed bed AFBC for phase 3, sub-system integration, requiring $1,200,000.

Question: What is the status of the hospital waste co-firing project?

Answer: The feasibility study for the hospital waste co-firing project is expected to be completed in June 1990. Congress has mandated a 50/50 cost co-sharing for any follow-on effort.

Question: What is the status of the TVA AFB demonstration plant?

Answer: TVA reached full-load 160 MWe operation on April 11, 1989. A number of unresolved issues are currently under study. The key issues included uncontrolled freeboard combustion (which resulted in convection tube failure), frequent blockage of bed drain, undersized ash discharge and occasionally under-bed feeding system outage.

Question: Have any significant operating results been obtained?

Answer: TVA demonstrated the viability of long-term operation with high (90%) sulfur capture. It also revealed that large scale AFB operation required internal heat removal to keep the combustor temperature controllable.

Pressurized Fluidized Bed

Question: What progress has been made on the development of the advanced PFB system?

Answer: Phase I, system definition, conceptual design and cost estimates, for the advanced PFB system was completed in March 1988. Based on Phase I results, Foster-Wheeler was authorized to initiate Phase II - component testing and development in April 1988. Some delay was experienced by Foster-Wheeler due to environmental permitting in the State of New Jersey. Topping combustion tests by Westinghouse Combustion Turbine Operations are currently underway.

Question: When will components be tested?

Answer: Testing of the topping combustor has already begun. Testing of the carbonizer is scheduled to begin in early 1991 followed by testing of the circulating PFBC fluidized bed heat exchanger, cyclones and cross-flow filter to begin in mid-1991.

Question: What are the major components or systems being developed and by whom?

Answer: Foster Wheeler Development Corporation is the prime contractor and is responsible for the development and design of the carbonizer, circulating PFBC, fluidized bed heat exchanger, cyclones, and auxiliary systems.

Westinghouse Combustion Turbine Operations is responsible for the development of the multiannular swirl burner topping combustor to be used in the second-generation system. In phase II, the topping combustor will be tested at the University of Tennessee Space Institute in Tullahoma, Tennessee.

Westinghouse Research and Development is responsible for predicting plant calcium-to-sulfur feed requirements, nitrogen oxide emissions, circulating PFBC combustion efficiencies, gas alkali levels and gettering requirements. Additionally, they will be responsible for performance testing of the cross-flow filter.

Gilbert/Commonwealth is preparing the conceptual design of a 450 MWe second-generation PFBC plant.

The Institute of Gas Technology is responsible for developing a carbonizer computer model and for assembling and operating the Phase III 5 MWe test facility to be located at its site in Chicago.

Question: Is requested 1991 funding sufficient to continue development on schedule?

Answer: FY 1991 funding is sufficient to continue development on schedule.

Question: When component testing is complete, what are the next steps you contemplate in the development process?

Answer: The next step in the development process is the initiation of Phase III - integrated subsystem testing, which is planned to take place in October, 1991.

Advanced Combustion

Question: Is funding requested in 1991 for industrial/utility applications and commercial applications of advanced combustion technologies sufficient to continue all the promising projects currently under development?

Answer: Yes, FY 1991 funding is sufficient to complete current projects. The FY 1991 request fully funds the Phase II industrial/utility projects. Award of Phase III contracts is scheduled for September 1990. Funding for Phase III in FY 1990 and FY 1991 is $690,000 and $578,000 respectively. Funding of the small-scale (residential/commercial) projects was completed in FY 1989 and project work will be completed in FY 1990. Award of Phase III contracts is scheduled for August, 1990. Funding for Phase III in FY 1990 is $987,000 and $1,000,000 for FY 1991.

Question: For the record please describe the current projects and their status.

Answer: Three projects comprise the Phase II industrial program--Vortec, MTCI and UTSI. Vortec and MTCI will complete Phase II activities in December 1990, and UTSI will finish in May 1991. Two residential projects are active in Phase II development--Tecogen and MTCI. Tecogen will complete Phase II in March 1990, and MTCI will complete their contract in September 1990. In the commercial applications area (not a phased program), Catholic University and the U.S. Navy will complete their work in May 1990.

Question: Please explain your "Combustion 2000" initiative and at what stage your implementation of it is.

Answer: Combustion 2000 is comprised of two parallel development programs:

- o Low emissions boiler system (LEBS)
- o High-performance power system (HIPPS)

The objective of LEBS is to improve the environmental performance of future coal-fired utility power plants; i.e., reduce SO_2 and NO_x emissions to one-third of current New Source Performance Standards (NSPS), reduce TSP (particulate) emissions to one-half of current NSPS, increase system efficiency by at least 10% over current pulverized coal plants with scrubbers, and reduce the cost of electricity.

The HIPPS' objective is to attain a cycle efficiency of 47% and a reduced cost of electricity, thereby reducing CO_2 emissions by 25% while concurrently reducing SO_2, NO_x, and TSP (particulate) to one-fourth of current NSPS.

The solicitation for LEBS is in preparation and is scheduled to be issued in April 1990. HIPPS implementation is under review and should proceed after LEBS.

Question: What interest is there from industry in developing these technologies?

Answer: The Pittsburgh Energy Technology Center (PETC) has received numerous inquiries from private sector firms about participation in the LEBS and HIPPS programs. Interest can be better evaluated after responses to the initial solicitation in April and June 1990 have been received.

Question: What is the overall scope of each of the two major thrusts of the program (low emissions boiler and high performance power system)?

Answer: The major activities of the LEBS program are:

- o Systems analysis and R&D planning
- o Component definition and preliminary commercial unit design
- o Engineering development and subsystem testing (2-5MWe)
- o Proof-of-concept test facility design (20-30MWe)
- o Proof-of-concept facility construction and operation

The major activities of the high-performance power system are:

- o Systems analysis and concept definition
- o Component development and integration
- o Integrated POC system design and construction (2-5 MWe)
- o Test and evaluation

Question: What is the expected program cost for each if fully implemented?

Answer: Costs for LEBS and HIPPS are estimated at $75 million and $55 million, respectively.

Question: What are the potential impacts of this program?

Answer: LEBS and HIPPS are technologies with greatly improved environmental performance for coal-based plants. HIPPS also reduces CO_2 by 25% in new plants. LEBS will assist coal-based capacity additions under the emissions cap of the Clean Air Act.

Question: What will be accomplished with the minimal funding requested in 1991?

Answer: The funds for the Combustion 2000 project, for FY 1990 and FY 1991, total $1,987,000. These funds will allow for one contract to be awarded for the Low Emission Boiler System project and one contract for the High Performance Power System project.

Question: With regard to the industries affected by the pending clean air act revisions, such as utilities and large equipment manufacturers, do you expect less money and manpower to be available for research and development on advanced technologies in coal and combustion cleanup systems and combustion systems from the affected parties as a result of the requirements of the legislation?

Answer: The funds allocated by large corporations for R&D are not likely to change dramatically with passage of the Clean Air Act amendments. It is more likely that in the time period between passage and implementation of the Clean Air amendments, R&D will be refocused to the longer-term requirements established by the amendments.

Question: On what do you base this opinion?

Answer: Most large corporations such as utilities and boiler manufacturers allocate a portion of their earnings to R&D. The financial conditions of utilities and boiler manufacturers traditionally do not change appreciably over short periods of time. Likewise, one would not expect R&D allocations to change appreciably.

Alternative Fuels

Question: Are the funds included for fire-tube boiler tests in 1990 sufficient to complete a reasonable program?

Answer: The $395,000 is sufficient to assemble components and perform shakedown runs. Without additional funds, the test program & post test analysis will not be completed. This program has a total estimated project cost of $2 million.

Question: What will be accomplished with the funds?

Answer: The FY 1990 funds for fire-tube boiler testing will be used to assemble components of the system and perform shakedown runs.

Question: What has been accomplished in the cooperative program with Italy on superclean slurries?

Answer: In August 1989, the Pennsylvania State University was selected to be the host site for the U.S. portion of the joint demonstration effort. Penn State is in the process of procuring a water-tube boiler designed for oil firing. PETC's Coal Technology Data Base was used to generate a list of candidate coals from which coals will be chosen for testing.

Question: What are the overall goals of the program?

Answer: The goal of the U.S.-Italy program is to show that a superclean coal-water slurry can be burned efficiently and in an environmentally acceptable manner in light industrial/commercial boilers designed for oil. The program is expected to demonstrate that coal-water fuels can be fired with minimal effects on an oil-designed boiler's performance and reliability.

Question: It it fully funded?

Answer: Yes, the program is fully funded, and no addiitonal funds are required in FY 1991.

Question: When will it be complete?

Answer: The program is scheduled to be completed March 1, 1992.

Question: There is a large reduction in 1991 for fuels characterization work. (p.55) Will this allow the program to continue to evaluate fuels?

Answer: Funding in FY 1991 is sufficient to analyze fuels with regard to chemical, physical, and rheological properties. Combustion characterization work will not be continued, however.

Question: What candidate fuels need to be tested?

Answer: Fuels are being prepared by Bechtel's selective (oil) agglomeration process using three coals -- Pittsburgh No. 8, Upper Freeport, and Illinois No. 6. These fuels, prepared in 20-ton lots, will be available for testing during the third quarter of FY 1990. It is likely that two of the fuels can be tested in FY 1990 in the 5MM Btu/hr facility.

Question: What is the schedule for doing so?

Answer: Two of the three fuels being prepared by the selective agglomeration process will be characterized and tested in the 5MM Btu per hour combustion facility by the end of FY 1990.

Question: Please describe the industrial capability to provide alternative fuels. Who are the active companies and what is their capability?

Answer: The current industrial capability to provide alternative fuels is very limited. Otisca, Amax, and Oxce have provided alternative fuels to DOE in batch mode in the past. Otisca's participation in the Clean Coal Program should enhance its capability to supply beneficiated coals. The Pittsburgh Energy Technology Center (PETC) issued in March 1990, a "sources sought" for supplying alternative fuels. Responses thus far include the following:

o CQ, Inc.; Homer City, PA; 10-20 tons per day.

- Coaliquid, Inc.; Louisville, KY; unspecified capacity (might still have operable plant of 1,000 barrels per day at Shelbyville, KY.)
- Jim Walters Resources; University, Alabama; 1-2 tons per day.
- OTISCA; Syracuse, NY; 15 tons per hour.

This list might increase if additional companies respond to the sources sought announcement.

Question: Is developing industrial alternative fuel capability a problem? If so, what can DOE do to address it?

Answer: Yes. Potential suppliers are reluctant to invest in large scale production facilities without a clearly demonstrated demand. Potential users of alternative fuels are reluctant to convert to such fuels without an in-place, reliable supply at a competitive price. The bottom line is that there is not sufficient demand at this time to warrant major investment in large scale production facilities. Batch mode production results in a very high fuel price. DOE is currently cost-sharing an alternative fuels production demonstration project with Otisca under the Clean Coal Program to reduce cost and risk associated with such projects. DOE is also currently meeting with potential fuel suppliers to determine what more can be done.

Question: Who provides fuels for the various DOE programs, such as the Italian/US agreement, the coal-fired diesel and turbine program, etc.?

Answer: In the recent past, several manufacturers have supplied fuels for various DOE programs. AMAX and OTISCA supplied fuels for the heat engines program. Energy International (EI) procured fuels from various suppliers, such as OXCE and AMAX, for the Advanced Combustion Technology Program. Vendors supplying fuels for the US/Italy program will be selected late in FY 1990. PETC is currently canvassing industry to assess its capability to supply fuels for the various DOE programs.

Question: Argonne National Laboratory has investigated a process of burning coal with a mixture of pure oxygen and coal-combustion gases to produce CO_2 for possible use as an oil recovery agent. Have you funded this technology?

Answer: No, this effort was funded by the Office of Industrial Programs, Conservation and Renewable Energy, DOE and was completed in FY 1988.

Question: What is the status of the technology and what is your assessment of it?

Answer: The program was completed in FY 1988 and consisted of tests in a stoker-type boiler of the Black Hills Power and Light Co. (South Dakota) and in a 50MM Btu per hour experimental burner. Gas streams containing 90% CO_2 were produced, and the technology is viewed as ready for application. Economic feasibility will occur when the price of oil reaches about $25 per barrel, but transportation distance from the combustion source to the oil field cannot exceed 200 miles.

Heat Engines

Question: For Turbines: Why is a decision made in the 1991 budget to reduce this program to one contractor from three?

Answer: Because of budgetary constraints and overall funding priorities, multiple approaches cannot be afforded and, therefore, the program is reduced from three contractors to one.

Question: Are there valid technical reasons to choose one contractor in 1991?

Answer: Yes, there are measurements of technical progress which can be used to choose one contractor in 1991.

Question: Are turbines being developed for the same applications?

Answer: Two contractors are working toward industrial cogeneration, and one contractor is working toward utility applications.

Question: Are the turbines similar in concept?

Answer: Yes, the turbines are similar in concept. The major differences will be in the configuration of the combustion system and type of gas stream cleanup.

Question: What would it cost in FY 1991 and through conclusion to fund all three contractors?

Answer: The funding required to complete the present contracts through proof-of-concept tests is:

(dollars in millions)

Contractor	FY 1991	FY 1992	FY 1993
GM Allison	$2.4	$3.4	$3.4
Solar Turbines	3.5	0.4	0
Westinghouse	1.7	0.3	1.5

However, due to budgetary constraints and funding priorities, only the single most promising approach will be funded in FY 1991. Therefore, no funding will be required for the other contractors either in FY 1991 or beyond.

Question: At what stage is each development, what progress has been made on each, and when would they be complete if fully funded?

Answer: All three contractors are presently conducting developmental combustion studies and tests using coal/water mixtures. Full-scale combustion tests are presently being initiated by GM Allison and Solar. Westinghouse will continue their combustion testing with a cascade test rig which will begin in the near future. All three contractors are investigating hot gas cleanup components to minimize emissions. If fully funded, all three contractors would complete their work in FY 1994.

Question: What is the status of the Morgantown advanced combustion test facility?

Answer: The construction of the research facility will be completed at the end of April 1990, and process equipment and instrumentation will be installed for the first stage of the Process Development Unit (PDU) by the end of the calendar year 1990.

Question: What will be tested in this facility, versus those of the industrial contractors?

Answer: The new facility, in addition to the PDU scale combustor (10 million Btu/hour), will be capable of integrated operations with hot gas cleanup equipment and a small commercial gas turbine. The PDU has been designed to handle high turbine inlet temperatures (2,500°F) and pressures (20 to 30 atm). Subscale combustors (1 million Btu/hour) will be available to support the PDU research by examining such issues as high-pressure atomization, pulse combustion, acoustic agglomeration, vortex combustion, and high-temperature slag operation, in direct support of the work performed by industrial contractors.

Question: What component development is being undertaken outside the work of the three systems contractors? Why?

Answer: Work has been initiated with Hague International for the development of ceramic heat exchanger technology. The development of this technology would permit the indirect-fired gas turbine to operate with clean air instead of combustion exhaust products. This is an alternative approach to the three gas turbine systems contractors.

Question: Why is it terminated in 1991?

Answer: Budget constraints and funding priorities necessitate cutting back some of the longer-term projects such as the Hague International effort.

Question: Where were these funds specifically provided in the 1990 request, or Congressional increase?

Answer: Funds were provided for the Hague International effort as a result of general Congressional additions to the Heat Engines program.

Question: For diesels: Why is a decision made in the 1991 budget to reduce this program to one contractor from two? Are there valid technical reasons to do so?

Answer: Because of budgetary constraints and overall funding priorities, multiple approaches were judged unaffordable. As a result, the development of only the single most promising technology will be continued in FY 1991.

Question: Are the diesel engines similar in concept or application?

Answer: The General Electric concept is a 1000 RPM, 3000 horsepower coal-fueled diesel engine aimed specifically at the railroad locomotive and marine application with the additional limited cogeneration use. The Arthur D. Little/Cooper Bessemer concept is a 400 RPM, 2 to 5 MW coal-fueled diesel engine for use only in the cogeneration market.

Question: What would it cost in 1991 and subsequent years to complete both contracts?

Answer: The funding required to complete the present contracts through proof-of-concept 100-hour tests is:

(dollars in millions)

	FY 1991	FY 1992	FY 1993
General Electric	$1.5	$1.8	$1.7
Arthur D. Little/ Cooper Bessemer	$3.2	$4.5	$0.1

Question: At what stage is each, what progress has been made, and when would each be complete if fully funded?

Answer: Both contractors are in the component development stage. They have proven the feasibility of the concept and are presently testing components in regard to their ability to withstand erosion and wear. Both contractors are also investigating exhaust gas cleanup devices to minimize emissions and meet anticipated environmental restrictions. If fully funded, both contractors would complete their work in mid FY 1993.

Question: Please explain the Caterpillar project, its status, and what its applications are?

Answer: The Caterpillar concept is the generation of high-pressure, low Btu gas in a batch-type coal processor for use as fuel in a diesel engine which is appropriately modified. The application is specifically railroad locomotive. The program consists of separately testing a bench-scale processor and a single cylinder test diesel engine fueled with simulated high-pressure, low Btu gas. The status of the work is that both test units are complete, and testing has begun. The scheduled completion date of the contract is August 1991.

Question: What component development has taken place outside the work of the two systems contractors? Why?

Answer: All component development work is being performed under the systems contracts by the contractor or subcontractors. There are additional Diesel Engine Program activities in the areas of combustion lubrication, wear, and higher-speed engine testing. The results of this research supports the work of the systems contractors.

Magnetohydrodynamics (MHD)

Question: Your report of February 1, 1990, containing revised costs for completion of the proof-of-concept program for MHD shows fiscal year 1991 costs of $35 million. What are those costs in current budget year dollars?

Answer: The current year costs for FY 1991 are $40.3 million.

Question: For the 1991 costs please explain for the record in what program areas they would be spent?

Answer: The planned expenditures are:

	($ in million)
- Integrated Topping Cycle Hardware and CDIF	$ 24.5
- Integrated Bottoming Cycle Hardware and CFFF	9.7
- Seed Regeneration	2.4
- System Studies, Supporting Research, and Conceptual Designs	3.7
Total for FY 1991	$ 40.3

Question: What is the technical status of the program?

Answer: The MHD POC program is in its third year with good progress being made. All technical issues for proof-of-concept have been identified and are being addressed. Design of the POC topping cycle hardware is scheduled to be completed in FY 1990. POC tests at the Coal-Fired Flow Facility (CFFF) on bottoming cycle hardware now total 1295 hours on Eastern coal. The "Econoseed Process" for seed regeneration has been selected for scale-up demonstration. Two repowering conceptual designs were completed -- the Corette plant in Billings, Montana, and the Sholtz plant in Sneads, Florida.

Question: What is the extent of the utility industry's interest in the program?

Answer: The degree of interest varies with each individual utility and ranges from moderate to enthusiastic. Overall, the utilities are supportive of the government's effort in the MHD program since they recognize the potential for environmental and economic benefits in the longer term. A national users group on MHD exists under the auspices of the Edison Electric Institute (EEI) and there is also an EEI Task Force on MHD.

Question: How actively are the Electric Power Research Institute (EPRI) and the Edison Electric Institute (EEI) participating?

Answer: EPRI provided the inverter at the MHD test facility in Montana which will be used in POC tests. In addition, EPRI participates on the POC integration task force. EPRI recently sponsored a MHD-Utility Colloquim in which EEI participated. EEI sponsors a national MHD Users Group and has a task force on MHD.

Question: Upon completion of this program, how long would it take to build and test a retrofit demonstration of the technology?

Answer: It is estimated to take approximately 7 years for a retrofit demonstration, with about 5 years for construction and 2 years of operation.

Question: With regard to cost sharing, if the program is continued in fiscal year 1991 and then to completion, what is your assessment of industry's ability to meet the increasing percentages of cost sharing anticipated in the FY 1990 appropriation?

Answer: Although increased cost sharing places a greater responsibility and burden on industry, they should be able to meet the cost-sharing requirement.

Question: What kinds of cost-sharing have been received to date?

Answer: The kinds of cost-sharing received to date include in-kind contributions such as contributed hardware, reduced fees, service, and facilities for testing.

Question: For the record, please describe the program for military/space applications of MHD and its status.

Answer: This program is a feasibility assessment of multi-megawatt space-based MHD power systems. It is a two-phase multi-year program, fully funded by the Strategic Defense Initiative Organization (SDIO), which was planned to culminate in the ground demonstration of a prototypic 100 MW system. The principal effort under the first phase, which will be completed during FY 1990, was the selection and critical component testing of two combustion-driven system concepts. Upon completion and analysis of these tests, the original planning schedule called for an RFP to be issued for the second phase demonstration program.

In early FY 1990, the Department was notified that the SDIO was re-assessing their program priorities and that some changes to the schedule and/or scope of the second phase effort could be anticipated. At this time, the Department has received $2.4 M of the $3 M budgeted by the SDIO to complete the first phase effort, and is awaiting guidance from the SDIO regarding development of possible modifications to the structure and schedule of the second phase.

Fuel Cells

Question: In phosphoric acid systems: What is the status of International Fuel Cells (IFC) on-site fuel cell development?

Answer: International Fuel Cells Corporation (IFC) is continuing to market 200 kW on-site fuel cell systems and reports over 50 orders received. Several preprototype 200 kW units have been delivered and production units are scheduled to be delivered beginning in 1992.

Question: Is the Department providing any assistance to the on-site effort?

Answer: As directed in the FY 1990 appropriations, funding of $740,000 within the Unconventional Gas Recovery program was provided for advanced gas-fired on-site fuel cell development. This work is being done at IFC.

A fully funded four year contract (1988-1992) for $9.5 million continues with IFC for improvements in power density and cost of the configuration "B" electric utility scale systems. Improvements are also expected to be applicable to on-site systems in the areas of lower cost materials and improved reliability.

Question: Is the fuel cell effort in unconventional gas recovery (p. 105) related to this?

Answer: Yes, the $740,000 of FY 1990 funds appropriated in the Unconventional Gas Recovery program are funding IFC on-site fuel cell development and testing of a short stack of an advanced design.

Question: What effort remains on the IFC configuration "B" development work?

Answer: The fully funded IFC configuration "B" contract will continue to mid 1992. The remaining effort includes further improvements in design to reduce costs by 25 percent and verification through testing of one small area (1 square foot) stack and several short stacks of full size cell area (10 square feet).

Question: Would that work be applicable to on-site fuel cells or only to utility size plants?

Answer: A significant part of the Configuration "B" development would also be applicable to on-site fuel cells. The elevated operating pressure and temperature of the electric utility scale, Configuration "B" fuel cell stack provides a more corrosive environment and presents higher stress levels than the on-site stack experiences in its operation at near atmospheric pressure. Materials and some fabrication techniques developed for the Configuration "B" system should also extend the useful life of the on-site system and increase reliability. Lower cost raw materials and improved manufacturing techniques for carbon cell components and improved catalysts are examples that should be readily applicable to on-site systems.

Question: With regard to the Westinghouse program, what will be accomplished through 1990?

Answer: Westinghouse plans to fabricate their first full size 375 kW module in 1990.

Question: What additional work and funding would be required to complete the program proposed by Westinghouse?

Answer: Completion of the program would involve testing of the first 375 kW module in 1991 plus subsequent fabrication and testing of a second 375 kW module incorporating modifications, if necessary. The estimated cost for completing the proposed program would be about $12 million. As cost-sharing for this program was received early on, the proposed estimate for completion is total federal costs.

Question: Does Westinghouse have demonstration or commercialization plans based on the complete program? If so, explain.

Answer: Westinghouse plans to test the second 375 kW module in a system supplying power in a commercial facility. Negotiations are currently underway among the parties involved. Westinghouse is proceeding with expansion and upgrading of facilities needed to satisfy 375 kW module production and testing. However, commercialization plans have not yet been announced by Westinghouse.

Question: How would loss of government funding affect those plans?

Answer: Without government funding, Westinghouse would have to provide its own funding or find alternate sources of funds in order to continue the testing of the first 375 kW module, fabrication of the second module, and the planned systems demonstration.

Question: Technically do the currently developed fuel cells meet the overall goals initially established for the program?

Answer: Westinghouse has demonstrated the overall pre-commercial performance goals in a 1000 hour test of a 100 kW stack and in tests of over 10,000 hours with smaller stacks. The goal of lifetime operation of full size 375 kW modules for 40,000 hours has yet to be demonstrated.

Question: In molten carbonate systems: What effect does reducing funding for stack development from $16.5 million to $5.6 million have on this program?

Answer: The level of effort would be reduced on the two cost-shared system/stack development contracts to be initiated in FY 1990. This would likely cause a stretch out of the program unless private sector funding was increased.

Question: Will any significant progress be able to be made by three contractors operating at that level?

Answer: If three contractors were continued, some progress would be expected to continue with a reduced effort focusing on the more critical problem areas on a stretched out basis.

Question: What general level of funding was assumed in the recent procurement action for this technology?

Answer: The planning for the currently on-going procurement action anticipated three year contracts and funding levels generally comparable to, or slightly above, FY 1990 levels. The contract allows work plans to be adjusted according to funds available, however.

Question: What is the status of the procurement?

Answer: Proposals were received by February 20, 1990, and are presently being reviewed. Selection is expected by late spring 1990 and contract awards before the end of FY 1990.

Question: What funding would be needed in FY 1991 to carry out the intent of the procurement for stack development and testing?

Answer: With the contracts not yet negotiated, the actual funding needs and amount of cost-sharing are not yet known. However, to maintain the level of effort anticipated, it is estimated that the funding from all sources for system/stack development and stack research would have to be generally comparable to, or slightly above, the FY 1990 levels. (DOE FY 1990 funding for molten carbonate was $16.8 million and total private sector funding in this area is estimated to be approximately $8 million).

Question: In advanced concepts: the Westinghouse solid oxide contract would be reduced by 90%, to $891,000 in FY 1991. What effect will that have on the program?

Answer: The level of effort would be reduced to focus on only a few critical areas and the program would be stretched out unless private sector funding was comparably increased.

Question: What will have been accomplished in 1990 on this program?

Answer: Westinghouse will fabricate and test the first 20 kW generator in FY 1990 and scale up self supporting tubes which have shown a 50 percent increase in power density.

Question: Is there significant cost-sharing, or related investment outside this contract, by Westinghouse and others? (provide details for record)

Answer: Yes, the Westinghouse tubular solid oxide contract has significant cost-sharing ($9.7 million) by Westinghouse. Additional private sector funding outside this contract on related tubular solid oxide work at Westinghouse has also been provided by the Gas Research Institute, the Electric Power Research Institute, Westinghouse and others. Total industry funding from 1985 through 1989 exceeded $27 million (including $19 million of Westinghouse funds). DOE funding over the same period was $24 million.

Question: What would it cost in FY 1991 to continue the program on its current schedule?

Answer: Continuation at the current schedule would require funding at approximately the FY 1990 level of $8.9 million.

Question: What would you expect to accomplish?

Answer: We would expect to further test the 20 kW generator, fabricate and test an improved generator, and continue improvement of the larger and higher performance cells.

Question: What will be accomplished on the monolithic solid oxide contract with Allied Signal?

Answer: In FY 1990 Allied Signal will fabricate and initiate tests of multicell units, striving to replicate performance achieved in single cells, and demonstrate increased durability and reliability.

Question: Is that the completion of the work originally planned? If not, what would have been done to fulfill the contract and what funding would be necessary in 1991 and future years to do that?

Answer: This is not the completion of the originally planned work. The current Allied Signal contract term is three years (9/89 to 9/92). In FY 1991 and beyond the remaining work would have continued testing of multicell units initiated in FY 1990. The contract value is $6,174,000 (including contract cost-sharing of $249,000) and funding through FY 1990 will be $3,421,000, leaving $2,504,000 in 1991 and future years that would be necessary to fulfill the contract.

Question: What are the advantages to the Westinghouse and Allied Signal technologies that make them attractive to potential users?

Answer: The use of solid electrolyte by Westinghouse and Allied Signal is expected to provide benefits of reliability and long life. Also, the higher temperature operation provides the potential for improved thermal energy utilization in cogeneration applications. Fuel preparation and cleanup is also reduced for potential cost and reliability advantages. If the monolithic approach of Allied Signal is successful, the higher power density will further reduce package size, as well as cost, and broaden applications.

Question: In advanced research and advanced concepts fuel cell areas, are other advanced technologies being investigated? If so, what technologies and at what funding level? If not, are there other potential technologies that could be investigated? Should they be?

Answer: Yes, other advanced technologies are being investigated under the "Advanced Research" subprogram which is presently supporting the concepts of molten carbonate and solid oxide fuel cells. Within these areas, work is ongoing on advanced techniques including electrode, catalyst, and material-related investigations. Funding for these efforts is $667,000 for FY 1990 and $348,000 for FY 1991. Presently, the "Advanced Concepts" subprogram is appropriately funding development of solid oxide concepts, previously discussed, and characterization of materials.

Surface Coal Gasification

Question: In power production, what is the rationale for expanding the test program for gas cleanup with GE?

Answer: The GE test program was originally scheduled for completion at the end of FY 1990, but was extended because continued testing with expanded operating hours could directly benefit planned Clean Coal IGCC demonstrations as well as provide additional useful test data on hot gas desulfurization sorbents. The GE program is actually more than just gas cleanup testing; it is operation of an integrated gasification/hot gas cleanup/turbine simulation/small scale test facility that will also provide additional information on gasifier components such as turbine valves.

Question: In power production, how can the GE program be expanded with less funding in FY 1991?

Answer: Expansion of the GE test program refers to continued testing with expanded operating hours beyond those scheduled in FY 1990. In effect, the FY 1991 request is for continuing the on-going program. This is highly desirable since the GE facility has already been constructed and useful information from expanded testing of alternate sorbents (e.g., zinc titanate) in IGCC gasification systems will continue to be obtained that would directly benefit planned Clean Coal IGCC demonstrations. This continued testing can be accomplished with less funding than was required in FY 1990, since part of the FY 1990 funds was for the completion of construction of the facility and for plant start-up/shakedown efforts.

Question: What will be accomplished in the continuation of the Texaco cleanup program in 1991?

Answer: The FY 1991 request is for the design and construction of an integrated gasification/hot gas cleanup system using the existing Texaco gasifier at their Montebello, California research facility. Start-up and shakedown is planned for FY 1992. The integrated gasification plant will be operated for at least one year starting in FY 1993, in order to verify and characterize entrained-flow gasification/hot gas cleanup system performance over a range of conditions expected for commercial power generation systems.

Question: How much has been spent through FY 1990 for the new fixed-bed and fluidized-bed gasifiers at the Morgantown Energy Technology Center (METC)?

Answer: Currently, through FY 1990, $200,000 has been spent for the design of the fixed-bed gasifier, and $30,000 has been spent for the design of the fluidized-bed gasifier.

Question: How much is budgeted for each in 1991?

Answer: Both of these projects are being re-evaluated based on a feasibility study of a 5 foot fixed bed gasifier and the on-going hot particulate control research effort by the Southern Company Services that involves a fluid-bed gas source.

Question: How much, by year, for each is required to complete construction?

Answer: The estimated cost to complete the construction for each gasifier is as follows:

	FY 1991	FY 1992	FY 1993	FY 1994
Fixed-Bed Gasifier (16")	$800,000	$500,000	$ 0	$ 0
Fluid-Bed Gasifier (12")	$1,000,000	$1,000,000	$600,000	$ 0

Both of these projects are being re-evaluated based on a feasibility study of a 5-foot fixed-bed gasifier project and the on-going hot particulate control research effort being conducted by the Southern Company Services that involves a fluid-bed gas source.

Question: What testing will be done there that cannot be done in existing industrial facilities?

Answer: The fixed-bed gasifier would operate at pressures up to 600 PSI to provide operating data needed to integrate a gasification/gas cleanup system with an advanced combustion turbine (STIG). No U.S. research facility exists with a fixed-bed gasifier that can operate at that pressure. In addition, the gasifier would be segmented to allow design changes for technology improvements needed for a broader full market application. No such gasifier currently exists. METC would seek an industrial partner to cooperate in this research.

Question: In you opinion, what steps are necessary to develop the industrial ability to commercialize integrated combined cycle coal gasification plants (IGCC)?

Answer: There are several major technical issues concerning various parts or components of the IGCC system that must be resolved prior to moving toward commercialization.

In-situ Desulfurization: Limestone or dolomite in fluidized-bed gasification provides the ability to capture 90 percent or more of the sulfur in coal as calcium sulfide (CaS). This sulfide containing waste could probably be landfilled, but, converting the majority of CaS in this material to calcium sulfate for recovery as elemental sulfur should be more desirable from an environmental permitting viewpoint. Therefore, a long-term demonstration of conversion of CaS is needed.

Particulate Control: Satisfactory particulate control feasibility studies/testing were demonstrated by GE for fixed-bed gasification and by KRW for fluid-bed gasification. However, long term operability of particulate filters on gasifier raw gas is needed to answer issues such as filter blinding, trace alkali attack on ceramic binder material, durability of ceramic filter seals, etc.

External Desulfurization: The key issue is sorbent mechanical and chemical durability through multiple regeneration cycles; this must be addressed by long-term operability testing at a dedicated gasification facility. Also, economic disposal of sulfur dioxide produced during sorbent regeneration needs to be proven for gasifier systems where sulfur dioxide recycle to the gasifier for in-situ desulfurization is not feasible.

Question: Do you expect utilities to own and operate the gasification/cleanup portion of such facilities themselves?

Answer: Yes. Once commercial, IGCC plants would be owned and operated just like any other utility plant, either by the utility itself or by an independent power producer.

Question: Are these plants more amenable to being constructed and operated by independent power producers than regular utility companies?

Answer: Since IGCC plants can be either stand-alone "greenfield" facilities or can be integrated into larger plants or used to repower existing plants, they are equally amenable to construction and operation by both utilities and independent power producers.

Question: What kind of warranty or performance guarantee provisions are likely to be necessary to develop this technology?

Answer: Minimum warranty or performance guarantee provisions required for acceptance of IGCC technology will likely include (1) that the plant will operate at its rated output, (2) that it will operate within given limits for heat rate or efficiency, and (3) that the plant will have an acceptable on-line availability or higher on-stream factor.

Question: Are there combinations of suppliers, constructors, and engineering firms currently willing to commercialize these plants?

Answer: Yes. Houston-based Texaco and Dow Chemical Company (through DESTEC, its commercialization arm) both currently offer oxygen-blown IGCC systems with cold gas cleanup. In fact, Texaco has just recently announced plans to build, with the General Electric Company, a 440-MW IGCC plant at Freetown, Massachusetts.

At least three other companies are expected to be offering commercial systems as soon as successful demonstrations can be achieved. These include Shell Development Company (Houston) which is currently constructing an oxygen-blown entrained-flow IGCC with cold gas cleanup in The Netherlands, and the M. W. Kellogg Company (Houston) and Tampella Limited (Helsinki, Finland) which are independently pursuing plans to demonstrate air-blown fluidized-bed IGCC systems with hot gas cleanup. The Shell demonstration plant is scheduled for operation in 1992; Shell may begin serious commercialization efforts in the U.S. shortly thereafter. Tampella would use U-Gas gasification technology recently licensed from the Institute of Gas Technology (IGT) and would likely commercialize their system through Tampella-Keeler (formerly the Keeler Division of Dorr-Oliver of Milford, Connecticut). Kellogg, an A&E firm, would base its system on the KRW fluid-bed gasification process, but has not yet announced plans for commercialization.

Question: In synthesis gas: What is the significance of the study of a gasification system for high quality transportation fuel?

Answer: The production of clean synthesis gas accounts for up to 60 percent of the cost of producing liquid transportation fuels from coal by indirect liquefaction technologies. Synthesis gas also plays a major role in the production of hydrogen used for producing liquid transportation fuels from coal by direct liquefaction. The purpose of this activity is to conduct analysis to determine ways to reduce the cost of clean synthesis gas from coal for producing hydrocarbons and oxygenated fuels for the transportation sector.

Question: What is the impetus for this work?

Answer: The United States continues to be a net importer of petroleum crude and finished products and imports are on the rise. Over 6 million barrels per day of petroleum products are utilized in the transportation sector. Both direct and indirect liquefaction of coal have been suggested as means for reducing our Nation's dependence on imported oil. Both of these technologies require synthesis gas as an intermediate for the production of liquid transportation fuels.

Underground Coal Gasification

Question: At what test sites is continued environmental activity expected to be required in 1991? (p. 67)

Answer: Groundwater monitoring activity will continue at both the Rocky Mountain #1 and Hoe Creek sites during 1991. The work at Hoe Creek will also involve groundwater treatment.

Question: What continued effort is expected with the Western Research Institute in FY 1991?

Answer: The effort with the Western Research Institute in 1991 involves groundwater sampling and core analysis at the Rocky Mountain #1 test site and providing support for the cleanup at the Hoe Creek gasification site.

Unconventional Gas Recovery

Question: The natural gas research and development implementation plan does not seem to be as well-defined as the oil plan. What are its main emphases, and how have they changed from the previous program?

Answer: The natural gas program implementation plan released for public comment in January 1990, has been greatly revised. The revised plan is more focused and adds increased emphasis on near-term research efforts. The near-term emphasis is reflected by the initiation of a conventional gas R&D program which focuses on increasing gas recovery from known conventional gas reservoirs. The conventional gas effort is complementary to present unconventional gas recovery research.

Question: The briefing material on the plan indicates the initiation of work on conventional resources in 1991. What work will be undertaken?

Answer: Research efforts in conventional gas resources proposed for FY 1991 include: development of a natural gas data base system; development of reservoir classification systems; low-quality gas assessment; and development of gas atlases. Also included is the completion of the secondary gas recovery project.

Question: At what cost?

Answer: The cost of the conventional gas R&D initiative is $4.0 million. In addition, the requested funding for the secondary gas recovery project is $650,000.

Question: Where is this identified in the budget?

Answer: The $4.0 million requested for the consortia initiative under the Environmental and Advanced Research subactivity (p. 105) represents the conventional gas research effort. The $650,000 requested for the secondary gas recovery project is also part of the Environmental and Advanced Research subactivity.

Question: How has the plan been coordinated with the gas industry and the Gas Research Institute?

Answer: Many comments have been received by industry and the Gas Research Institute as a result of a public hearing and the release of a draft gas implementation plan for comment in January of 1990. The gas plan has since been greatly revised, incorporating many of the comments that have been received. Future work efforts in the gas plan will include close cooperation and coordination with the Gas Research Institute.

Question: How does the plan address resource and reservoir geoscience work versus enhanced technology processes?

Answer: The plan continues resource characterization and definition work for both eastern and western tight resources. In addition, multi-strata assessment and fractured reservoir research continues for both resource areas. Enhanced technology (recovery) processes are reflected by a continued strong effort in the application and evaluation of slant/horizontal well technology in tight resources. In addition, the secondary gas recovery project will continue to investigate methods to enhance gas recovery from known conventional reservoirs. A complementary project to the secondary gas recovery project is expected to be initiated and will emphasize geophysical approaches to enhanced gas recovery.

Question: The oil plan has developed a system to identify priority resources and technologies. Are you developing such a system for the gas program?

Answer: Yes, future efforts are planned to address and develop a more rigorous prioritization scheme.

Question: When will it be available?

Answer: Work on a priority scheme is expected to begin shortly and much of the next year is expected to be devoted to developing such a scheme. A scheme might be available in approximately a year or less.

Question: The briefing material states the program broadens the scope of the present unconventional gas recovery program. How does it do that?

Answer: Basically the gas plan broadens work efforts in both the eastern and western tight resources. For example, although a coalbed methane project has not been developed in the plan, where gas-bearing coals are encountered in our field tests, it has been included in our reservoir evaluation process.

Also, our long-term research effort has been broadened to include work in new plays, for example rift systems and thrust areas; and also in seismically opaque zones, i.e., areas where seismic records to-date have been uninterpretable.

Question: In eastern gas shales: What has been the result of horizontal drilling in eastern shales? (p. 102)

Answer: In 1986, a 2000 ft. horizontal well was drilled and stimulated in Wayne County, West Virginia. This particular test did not demonstrate the economic viability of horizontal wells in eastern shales. Since then a slant well and an additional 2000 ft. horizontal well have been drilled. Stimulation and testing activities are presently ongoing at both wells. Results to date are encouraging. Two additional 2000 ft. tests are planned for 1991.

Question: What additional work is contemplated in 1991?

Answer: Efforts will be expanded to conduct research in horizontal drilling in shallow gas reservoirs, i.e., less than 1500 feet. An Request for Proposals (RFP) will be issued in late 1990 for multiple awards of horizontal tests in shallow tight gas formations in the Appalachian, Illinois, and mid-continent areas.

Question: When will the technology be commercially viable?

Answer: Experience indicates that the technology will most likely be commercially attractive when the production rates are at least 3-fold better and the well costs twice or less than twice the costs of a vertical well. Drilling costs have been reduced from 4.5 times to 2.5 that of a vertical from DOE's first horizontal well to the second horizontal well. Stimulation costs still remain very high.

Question: At what gas price?

Answer: A gas price at which horizontal well technology will be commercially viable has not been calculated. Any calculation of gas prices required would be based on an assumption of constant cost of technology. Viable economic conditions will depend more heavily on reducing well costs and dry hole risk. DOE's horizontal well testing and evaluation are aimed at reducing both well costs and dry hole risk rather than relying on any projected or expected upward movement of gas prices to make the technology feasible.

Question: In western tight sands: What is the status of horizontal/slant drilling?

Answer: A contract for the slant/horizontal test was awarded to CER Corporation late in 1989. The site has been constructed and drilling is expected to begin early in April of 1990.

Question: What is proposed in this technology in 1991?

Answer: In 1991, the horizontal section of the slant horizontal well will be completed, tested, and fully evaluated. This completion will be in the Upper Cozzette sandstone. Also, the slant portion of the well through the Paludal section will be fully tested prior to stimulation, which is expected to take place early in 1992.

Question: Is it planned to close the multi-well site when the drilling proposed in 1991 is completed?

Answer: Slant hole testing and evaluation will be completed in mid-1992. At that time it is planned to close both the multi-well and slant hole sites. Final restoration of the site(s) is expected at that time.

Question: When is it expected that such techniques will be commercial?

Answer: One objective of the slant/horizontal well test is to investigate and determine drilling and production economics. Production rates versus well costs will define economics. This particular technique will become economical when gas prices and production rates rise relative to drilling costs. With Rocky Mountain gas prices presently at $1.20/MCF, it would be difficult to predict when this technique would be economic.

Question: Explain how the work from the multiwell experiment is expanded to other areas of gas potential. What areas have been or will be investigated?

Answer: The results of the multiwell experiment (MWX) are being extrapolated to other areas of the Piceance Basin through the use of wells of opportunity. These industry wells will be logged, cored, stimulated and tested utilizing concepts developed at the MWX. The results from such tests are then compared with the MWX data base.

The potentially productive part of the Piceance Basin has been partitioned into three areas based on similar reservoir behavior and production potential. One test has been conducted in the Grand Valley field in the Rulison partition.

Question: Of what promise are the results?

Answer: Phase I of the project has just been completed. This phase, which has been primarily geologic and engineering studies, has resulted in the partitioning of the Piceance Basin into three areas based on reservoir behavior and production potential. The field testing or verification phase has just begun. These tests are needed for the successful extrapolation of MWX results. Industry acceptance of the test verifications could lead to expanded drilling activity across the basin, assuming that market gas prices rise to a level where drilling economics become profitable.

Question: In environmental and advanced research: Explain why you are initiating work on air-drilled horizontal wells in 1991. (p. 104)

Answer: The testing and evaluation of advanced design air-driven motors are believed to be essential for improving the drilling rates of formation penetration. Also the testing and evaluation of improved diagnostic tools are critical to guiding the directional hole and to helping locate the target formation. Success in these efforts will have a direct bearing on reducing the costs associated with air drilling of horizontal wells. Reducing costs of these wells is necessary to bring down the investment to a level acceptable to independent producers.

Question: To what resources is this technology applicable?

Answer: The technology would be most applicable to the eastern tight gas resource, including both fractured shales and sandstones.

Question: What kind of diagnostics are being developed for studying fracture systems in gas formations?

Answer: Activities include testing and evaluation of geostatistical methods for locating naturally fractured reservoirs; geophysical methods using resistivity and acoustic techniques for locating fractured zones behind well casing; vertical seismic profiling (VSP) and passive seismic methods for mapping induced fractures.

Question: Are seismic techniques such as those being used in the oil program applicable?

Answer: Yes, vertical seismic profiling is applicable. However, refinements will be necessary to take into account the gas program's objective of locating natural fractures. This is not normally an objective of the oil program. Also, passive seismic listening will require improved signal processing capability to monitor the propagation of induced fractures. Well to well seismic tomography, under study in the oil program, would have limited application in the gas program due to the much larger well spacings required for gas production.

Question: Is this mainly a question of adapting currently available technology or are completely new concepts required?

Answer: Concepts for detecting natural fracture systems and induced fractures have been developed. What is required is a sustained testing and evaluation effort of improvements to existing technologies and methodologies so that a proper assessment can be made.

Question: What is the status of the secondary gas recovery project with GRI?

Answer: DOE signed a contract with the Texas Bureau of Economic Geology in September of 1988 and since that time 10 gas fields have been screened with an extensive data base being developed. This phase of the work has focused on sandstone reservoirs. Detailed geologic and engineering studies are nearing completion on four gas fields, with the fields located in southeast and southcentral Texas. A well may be drilled later this year to test concepts developed. A draft report on this phase of the study will be completed by the end of this calendar year.

The second phase of the project will focus on gas in carbonate reservoirs. Screening of reservoirs for more detailed studies has begun and will be completed during the fall of 1990, with data collection, analysis and report writing for the selected fields continuing through FY 1991.

Question: Will the funds requested in 1991 complete the project?

Answer: Yes, although some report writing may continue in FY 1992 at no additional cost to the government.

Question: Do you envision more projects like this in your gas implementation plan?

Answer: Yes, however with emphasis shifting to the application of advanced technology, particularly in the area of reservoir definition. Also, this type of research will be extended into other geologic and geographical areas. In addition, we anticipate research needs or specific technological barriers being identified as a byproduct of the secondary gas recovery project.

Coal Technologies

Question: The advanced research in specific program areas of control technology and coal preparation, coal liquefaction, coal gasification, fuel cells, and surface coal gasification has been reduced by 50 percent in 1991. What rationale was used to reduce this research?

Answer: The requested funds have been reduced in support of the Administration's efforts to reduce Federal spending and the increased emphasis in the Fossil Energy Program on programs with near term potential applications. The request, however, is sufficient to maintain a balanced research program.

Question: Is there a paucity of innovative ideas for these technologies or do you get significant responses to procurements in these areas?

Answer: Coal research scientists continue to generate innovative ideas and prepare proposals to explore new process concepts and to increase our knowledge in all of these advanced research areas. We do receive significant responses to our procurements and are funding the best proposals.

Question: In each of the above areas, please provide for the record the areas where you believe advanced research would have the most impact. Also designate the areas in which you are reducing funds and why.

Answer: For control technology, the most impact will be in reducing the deleterious solid (i.e. particulate) and gaseous pollutants production and discharge from coal utilization systems.

For coal preparation, the most impact will be on removing ash-forming mineral matter and SOx-forming sulfur from coal before use in either a gasifier or combustion system.

For coal liquefaction, areas where research would have the greatest impact are: (1) novel concepts for coal liquefaction including pretreatment to enhance coal reactivity and catalytic hydropyolysis (2) fundamental studies, including improved understanding of unwanted retrograde reactions that degrade product quality (3) research on biological processes to convert coal to liquids at substantially lower temperature and pressures than those currently employed and (4) use of high surface area, very fine particle-size catalysts for enhancement of coal liquefaction rates and product quality.

For fuel cells, the most impact will be upon identification and evaluation of advanced catalysts in molten carbonate and solid oxide cells, development of better components (electrodes, interconnection, structural parts) and creating improved tolerance to corrosion and fuel contaminants.

For surface coal gasification, the advanced research which will have the most impact is the work in gas separation and novel concepts for gasification including catalytic gasification and biogasification. This work has applications in the production of hydrogen and in the removal of pollutants from process gas streams. The separations work will also find application in other coal technologies, including the coal liquefaction area.

Funds are being reduced in coal liquefaction research on advanced process concepts, fundamental mechanisms of coal liquefaction, biological conversion of coal to liquids, and advanced catalyst; in surface coal gasification on coal structure, biogasification, and control of contaminants; in control technology and coal preparation on fundamental hot gas cleanup processes, hot particulate filtration, and surface science; and in fuel cells on catalyst contaminants and advanced solid oxide materials.

The requested funds have been reduced in support of the Administration's efforts to control Federal spending and DOE's increased emphasis on research with near term payoffs. The request is sufficient to maintain a balanced research program.

Advanced Research and Technology Development (AR&TD)

Question: What is the significance of the solids transport program?

Answer: The Solids Transport Program addresses the critical need to develop the fundamental data needed to improve the design and operation of plants that process solids materials suspended in gases or liquids, at high pressure and/or high temperature. This class of solids handling process systems have performed poorly compared to other parts of processes and little progress has been made toward improving their performance over time. Plant design should be based on fundamental information rather than empiricism. If the objectives of this program are achieved, the knowledge base developed will result in improved future plant operation and reliability.

Question: What areas are most in need of research and development based on assessment studies?

Answer: Assessment studies found a strong correlation between solids handling and poor process performance. At the same time, solids handling in fossil fuels processing plants is a critical plant cost component - 30-50% of total plant investment. Therefore, in the Solids Transport Program, research is carried out on a broad range of solids handling areas. These include both granular flow and multiphase (suspensions) flow.

Question: Have you recently changed the program structure to reflect focused research topics?

Answer: Yes. The program has been restructured to focus on specific "advanced research objectives" (ARO's) as well as a core program of exploratory research. Previously, the program had been able to address only exploratory R & D in solids transport. In FY 1990, a focused effort on a granular flow ARO was initiated with a PRDA. Planned for the future is a second ARO focus on liquid suspensions flow. The program structure also supports a continuing base exploratory R&D effort in all years.

Question: How many of these topics are to be investigated in 1990 and 1991?

Answer: In FY 1990, the granular flow ARO will be initiated and the core program of exploratory research will be continued. In FY 1991, the granular flow ARO and the core program will be continued at a reduced level.

Question: How can the program advance with a 50 percent reduction in funds?

Answer: In FY 1991, the reduced budget will allow a continuation of the base exploratory R&D effort together with a continuation of the granular flow ARO initiated in FY 1990, both at reduced levels. These activities will enable the program to continue the most essential research in this area.

Question: What is the level of effort necessary to carry out a single research objective?

Answer: A single ARO would require approximately $1,700,000 per year to proceed at the most efficient pace. However, considerable progress can be made at the currently proposed level of effort. Similarly, the core exploratory research would require approximately $900,000 per year to proceed at the most efficient pace. Important progress can be made however at the currently proposed level of effort.

Question: How do you arrive at that number?

Answer: An annual level of effort budget of $1,700,000 for an ARO is based on a the use of a multi-institution team which, with the technical coordination of a lead institution, can assemble a critical mass of effort focused on the ARO over a period of several years to properly address the many technical problems and avenues to solutions. This team concept includes use of 4-6 research performers. Performers on a team would include national laboratories, universities, industry, and the ETCs.

Question: Have any significant developments come out of the Instrumentation and Diagnostics program? If so, explain for the record.

Answer: Yes. Two very recent examples include:

o Development of an advanced alkali detector, the only one of its kind capable of determining alkalies in multiphase environments, was recently completed at the Los Alamos National Laboratory in this program. It already is in use by a private sector firm leading research in boiler slagging and fouling for a consortium of electric utilities.

o Development of a laser-based instrument that measures species in "dirty" gas streams has been under development at the Morgantown Energy Technology Center in this program. It is presently being installed on a Texaco Company gasifier and is scheduled for future installation on a Foster-Wheeler pressurized fluidized bed combustor.

Question: Explain why you are reducing the biotechnology program overall.

Answer: Research in biotechnology is being reduced as part of the Administration's overall effort to reduce the budget deficit and the Department's effort to increase emphasis on research with near term payoff. It should be noted that while the total budget for Fossil Energy R&D is being reduced by 51% from FY 1990 to FY 1991, the corresponding reduction in biotechnology is only 34%. The request is sufficient to maintain a balanced program.

Question: What are the funding levels expected in 1990 and 1991?

Answer: The crosscut and funding profile for biotechnology activities is shown in the following table.

Biotechnology Crosscut

($ in thousands)

Program	FY 90 Estimated*	FY 91 Estimated*
Control Technology and Coal Preparation	852	340
Advanced Research and Technology Development	1,390	1,765
Coal Liquefaction	974	386
Surface Coal Gasification	332	0
Advanced Extraction & Process Technology	0	500
Enhanced Oil Recovery	2,771	1,149
Total	6,319	4,140

*Data reflects funding estimates of contracts that will be awarded in the bioprocessing area from solicitations not yet awarded.

Question: In AR&TD there is actually an increase. Will all this research be done under Idaho National Engineering Laboratory control?

Answer: The estimate of $1,765,000 for FY 1991 in AR&TD includes an estimate of two grants awarded in the University Coal Research Program and $1,351,000 in the Bioprocessing of Coal Program. INEL will continue to provide this research, primarily through in-house activities. In addition, INEL will continue to (1) subcontract to four or five universities with special expertise (e.g., genetic manipulation, analytical capabilities, etc.) and (2) support university students working at INEL under the auspices of Associated Western Universities.

Question: In biogasification there is apparently industrial interest (Houston Lighting and Power and ARCTECH), yet the work has been deleted. Is it complete? If not, what is its status?

Answer: Arkansas University and ARCTECH each received contracts for biogasification work three years ago; these contracts are now being completed. The biogasification work is not ending; contract negotiations are currently underway with both for follow on work in this area which will be funded with FY 1990 funding.

Question: What is your assessment of the applicability of biotechnology to coal processes, and when it could make a significant contribution?

Answer: Research on the applications of biotechnology to fossil energy resource recovery and use is still in an embryonic state. It is considered high risk but with potentially very high payoffs, if successful.

However, we believe that high risk does not always equate with long term. Breakthroughs in biotechnology, when they occur, tend to occur rapidly and with very near term impacts. There are many instances of rapid developments in biotechnology and associated products in the medical and agricultural fields. For instance, if an ideal organism for coal desulfurization were discovered and if an ideal bioreactor system were found for employing the organism, a bioprocessing pilot plant could be designed, constructed, and operated to provide proof-of-concept within a five-to-ten year timeframe.

Question: Is it likely to do so at the reduced 1991 funding levels?

Answer: Although funding levels are reduced, a viable effort in biotechnology activities can be maintained by stretching out the current research activities.

Question: In International Programs, explain why activities are increasing in FY 1991. Is most of the activity information exchange, or are specific research and development activities undertaken?

Answer: The increase in FY 1991 funding for International Programs is due to the fact that this Office will be providing funding for the International Energy Agency's Coal Research Service (ICR), rather than obtaining funds from other FE program offices. The ICR is a jointly funded collaborative project of member countries of the International Energy Agency, located in London, which provides economic analyses, technical reports, and special studies related to coal supply and use. The U.S. currently funds one-third of the budget of the ICR (which is funded in British Pounds), but this figure is under negotiation.

While the exact amount of funding required is still under discussion, and the exact relationship of the U.S. dollar to the British Pound in FY 1991 is unknown, the additional funds are expected to cover the amount of shortfall between what had been historically provided by FE program offices in the past and the anticipated funds available. In addition, this Office will begin an effort to find alternative, supplemental funding from other Federal agencies, and from interested private sector organizations.

With the exception of the ICR, all FY 1991 international cooperative activities are expected to be either information exchange or task shared, and will involve no transfer of funds for specific research and development activities.

Question: Is the research funded under this activity or under the applicable program? If under the programs, please summarize both 1990 and 1991 activity.

Answer: With the exception of the ICR, all activities are either information exchange or task shared, and no research funds are required. The activities are all funded under this program.

Question: Please explain the status of the Polish agreement funded through the AID appropriation.

Answer: In FY 1990, $10 million was appropriated in the Foreign Operations Appropriations Act for two initiatives:

- the President's initiative, the Clean Coal Retrofit Project
- Equipment Assessment Project, to assess and help develop the capability in Poland to manufacture or modify equipment to use fossil fuels cleanly.

The DOE is responsible for both projects in conjunction with AID, since funds came through AID.

During a recent visit to Poland, DOE staff and staff of the Polish Ministry of Environmental Protection developed the specific text for an agreement. This agreement was signed on March 15 in Washington, DC.

In early April, a delegation from DOE visited Poland to identify the specific boiler that will be retrofitted with a clean coal technology system and to determine baseline parameters.

This information will be the basis for a planned competitive solicitation to supply the retrofit system. The solicitation will be issued this summer.

Question: In addition to the initial retrofit project, what other activities are contemplated in future years if authorized funds are appropriated?

Answer: A total of $30 million was authorized over 3 years, of which $10 million was appropriated for FY 1990. If the additional $20 million is appropriated in future years, it can be used to assess and develop Polish capability to manufacture or modify boilers, furnaces, smelters, and other equipment to enable domestic industrial facilities to use fossil fuels more cleanly, as now authorized in the Support for East European Democracy Act of 1989; or, subject to further review and approval by Congress, to pursue other agreed upon work to help curb emissions in Poland.

Question: Explain your coal technology export program.

Answer: The coal technology export program is comprised of several varied activities. The Assistant Secretary for Fossil Energy chairs the DOE Coal Export Initiative Program which coordinates intra-departmental activities and also is responsible for interagency coordination and cooperation in the coal and coal technology export area.

This program cooperates extensively with the coal and technology industry and trade associations. Public meetings, conferences, and workshops have been held. In cooperation with industry, DOE has published the "Guide to Federal Export Assistance Activities Applicable to the U.S. Coal and Coal Technologies Industries" and the "Directory of U.S. Coal and Technology Export Resources".

The Office of Fossil Energy (FE) currently has R&D Memorandums of Understanding (MOU) for coal technology with 26 countries (primarily Europe and the Far East). These MOUs consist of basic R&D. The Office of Planning & Environment has a Technical Cooperation Arrangement for Deployment of Clean Coal Technologies with Costa Rica. The purpose of this type of arrangement is to foster commercial deployment of U.S. developed clean coal technologies and is designed for Newly Industrializing Countries (NICs).

Fossil Energy coordinates the Department of Energy; U.S. Trade and Development Program and U.S. Agency for International Development joint agency financial support program for feasibility studies by U.S. companies for international energy trade opportunities.

As part of the coal technology export program, FE participates as a U.S. government representative on the United Nations/ Economic Commission for Europe Coal Committee. FE also participates on the U.S. Coast Guard coal transportation committees and activities.

Recently, DOE jointly sponsored along with the International Energy Agency and the Electric Power Research Institute a symposium on extending the performance of and retrofitting of fossil fuel plants. Last year the Office of Fossil Energy hosted a delegation from Malta who visited CCT sites and were provided opportunities to purchase turbines and coal.

An exhibit on the clean coal technology demonstration program has participated at international activities in the Dominican Republic and Thailand. The exhibit will be at ExpoMin '90 in Santiago, Chile in May.

Question: What is the international energy trade and development opportunities program? Who is involved? What criteria do you use to fund proposals? Are these strictly feasibility studies?

Answer: The "U.S. Federal International Energy Trade and Development Opportunities Program" has been formed by the U.S. Department of Energy (DOE), U.S. Agency for International Development (U.S.A.I.D.), and the U.S. Trade and Development Program (TDP). The objective of the program is to establish a formal cooperation and sharing of resources to support commercial development of international trade opportunities for U.S. industry and environmentally sound economic development world-wide through funding assistance for feasibility and planning studies.

Funding criteria for each agency are as follows. U.S.A.I.D. projects must (1) involve energy/power generation, transmission, distribution, operation or maintenance of energy/power facilities or other related activities in U.S.A.I.D.-assisted countries; (2) provide net, additional energy/power for environmentally sustainable economic and social development in the host countries; (3) propose cost sharing; (4) demonstrate technical and financial ability and experience of project proposer and/or project developer(s); and (5) demonstrate potential for actual implementation, as evidenced by a letter of intent or similar documentation. DOE projects must: (1) involve advanced coal technology/coal exports; (2) involve 50/50 cost sharing between DOE and the proposer of a feasibility or planning study; (3) be acceptable to the host country and demonstrate in-country presence of proposer; and (4) have a high probability of achieving a meritorious program objective, as determined by DOE, based upon DOE's evaluation of the facilities or techniques proposed for use and the qualifications of the project directors or other critical personnel. TDP projects must: (1) demonstrate that applicant is prepared to invest equity; (2) demonstrate that the applicant has the financial ability to undertake the export activities proposed for study; (3) involve the potential export of a significant amount of U.S. goods and/or services; and (4) demonstrate applicant's agreement to repay in full TDP's cost share of the study no later than four years from date of reimbursement (TDP reimburses up to 50% of applicant's costs upon completion of study).

Question: What work is being done in 1991. At what cost?

Answer: It is anticipated that the "U.S. Federal International Energy Trade and Development Opportunities Program" will continue in

FY 1991 with financial support for feasibility and planning studies. The estimated cost of continuing Program activities in FY 1991 is $1.25 million.

Question: From where are you obtaining the funding?

Answer: Funding to be used in FY 1990 for the "U.S. Federal International Energy Trade and Development Opportunities Program" is being provided through appropriated funds from each of the three participating agencies: U.S.A.I.D. from the "Energy Power Projects Feasibility Study Fund" - up to $15 million; DOE from the "Coal and Technology Export Assistance Program" (prior year unobligated funds) from direct appropriation, in accordance with Congressional direction in Conference Report 100-862, August 10, 1988, page 63, item (14) "$750,000 within available funds are for coal export-related activities so long as such activities in each case include the use of advanced technologies involving coal"; and TDP from the "Investor Assistance Program."

In FY 1991, funding in the amount of $1.25 million will be provided from the Coal Technology Export subactivity of the Advanced Research and Technology Development program.

Question: What additional work is being done in the coal and coal technology area?

Answer: FY 1990 technology export activities include: (1) grant to East-West Center for coal program; (2) coal and technology trade mission to Asia-Pacific region; (3) reverse trade mission - Asia-Pacific coal and technology industry representatives to U.S. sites and facilities; (4) seminar on economic modeling and evaluation for clean coal technologies in electric power generation; (5) Federal export assistance trade show; (6) study of innovative trade finance opportunities for international coal and coal technology projects; (7) negotiation of technical cooperation arrangement for deployment of clean coal technologies with Chile; (8) clean coal technology exhibit and presentation in Chile; (9) report "Innovative/Alternative Transport Modes for Movement of U.S. Coal Exports to the Asian Pacific Basin"; (10) report - "Proceedings of Asia-Pacific Coal Technology Conference - November 1989"; (11) study - "Opportunities for Blending U.S. Coal with Indigenous Coals in the Asia-Pacific Region"; (12) initiation of cooperative projects under "Technical Cooperation Arrangement for Deployment of Clean Coal Technologies" with Costa Rica; (13) revision and updating of "Summary Clean Coal Technology Characterization Report"; and, (14) updating and expanding of "Directory of U.S. Coal & Technology Export Resources."

Question: What is expected to be done in 1991?

Answer: The FY 1991 technology export program plan includes: (1) joint agency feasibility study funding program (DOE/U.S.A.I.D./TDP); (2) grant to East-West Center for coal program; (3) coal and technology trade mission (location TBD); (4) seminar on economics and commercial implementation of clean coal technologies in the international marketplace; (5) major international coal and technology symposium and exposition for U.S. technologies and vendors (location TBD); (6) negotiation of technical cooperation arrangements for deployment of clean coal technologies (countries TBD); (7) study evaluation of unconventional market niches for clean coal technologies; and, (8) clean coal technology international exhibits (locations TBD).

Program Management and Support

Question: How much internal research and development is anticipated at each of the Energy Technology Centers (ETCs) in 1990 and 1991?

Answer: In-house research and development at the ETCs in FY 1990 and FY 1991 is shown in the following chart:

	FY 1990	FY 1991
	($ in thcusands)	
METC	$18,340	$12,236
PETC	15,587	11,957
Total	$33,927	$24,193

Question: Could even the reduced 1991 level be accommodated with the current program direction funding for 1991?

Answer: The FY 1991 program direction request assumes considerable restructuring of the current program. Some nonessential buildings would be mothballed and facility maintenance, utility and security services would be reduced in conjunction with the reduced facility requirements. To the extent possible, some administrative and budget/finance functions would be consolidated and centralized at Headquarters. In addition certain costs previously charged to program direction would be charged to the R&D programs.

Question: The conference report on the 1990 appropriation requested that the Department review the size of your Headquarters staff with the goal of prudently reducing it. What is the status of that review?

Answer: The Office of Administration and Human Resource Management will be conducting a manpower resource survey of the Office of Fossil Energy Headquarters staff, and those of the Morgantown and Pittsburgh Energy Technology Centers during the next six months.

This survey will be used, in part, to help determine areas where Headquarters staff could be properly reduced.

Question: Do you expect you can reduce the Headquarters staff level?

Answer: Yes. The Fossil Energy historical attrition rate of 10% suggests that reductions can be made, and, in addition, I have instituted a policy of reviewing all personnel actions with the objective of reducing Full Time Equivalent (FTE) utilization wherever possible.

Question: How can you do that while increasing the number of noncareer personnel?

Answer: There are no plans to increase the number of noncareer personnel. There are 9 Schedule C employees and 1 noncareer SES currently on-board. This represents a reduction of 2 Schedule C employees from November 1989. Historically, the number of Schedule C employees in Fossil Energy averaged from 3 to 4.

Question: Please explain how the Department came to the conclusion that personnel from the Fuels Program transferred from the Economic Regulatory Administration should be included in the personnel floor figures for Fossil Energy R&D?

Answer: Since the Congress placed the FY 1990 funding for the Fuels Programs in the Fossil Energy R&D appropriation and also increased the staffing floors, this was interpreted to mean that the Fuels Programs staffing was to be included in the Fossil Energy R&D account as well as the funding. However, because of the concerns of the Congress, I intend to modify our accounting for the Fuels Programs staffing to exclude them from the legislated floors. The result of this action is that the staffing allocation for Fossil Energy R&D is now 740 in FY 1990 and 744 in FY 1991.

Question: With regard to personnel, reports from Human Resources Management show 280 people at Pittsburgh Energy Technology Center (PETC) as of November 18, 1989, and 260 as of January 21, 1990. Data from Fossil Energy shows 276 in March. Can you explain this wide fluctuation in numbers?

Answer: On November 2, 1989. PETC was issued a voucher of 290 FTEs in the FE R&D account and 30 FTEs in the Clean Coal account subject to change after the OMB passback. PETC decided to transfer personnel who were working on the Clean Coal program from the FE R&D

account to the Clean Coal account. Fossil Energy Headquarters was unaware of the transfer of personnel from FE R&D to Clean Coal and continued to report the higher number in FE R&D. A revised voucher has since been issued to PETC reducing the Clean Coal number to 16 FTEs, therefore, PETC is in the process of transferring the FTEs back to the R&D account.

PETC is aggressively recruiting personnel for the FE R&D account to meet the Congressionally mandated floors.

Capital Equipment

Question: For capital equipment: Please explain the extent of computer upgrading involved at PETC, how long it will take, and what the cost by year is expected to be.

Answer: The computer upgrade at the PETC central computer facility is still being discussed. Until this process is complete, final schedules and costs cannot be estimated. However, the initial planning cost was $3.4M in TEC over a two year period.

Question: Upon completion what will be the overall computer capability there?

Answer: The three existing mini-computers will be retained. The stand-alone mini-computer will continue to independently support the center's budget and accounting operations. The upgrade will provide additional administrative capabilities as needed, and an additional capability will have been either contracted or acquired to perform more sophisticated numerical simulations than are currently practical in-house.

Question: What will be the capability of Morgantown?

Answer: The Morgantown Energy Technology Center (METC) central computer facility includes 5 mini-computers integrated into a network cluster. A mainframe scientific computer is also accessible through the network that provides larger-scale computing capability to support scientific and engineering applications. A mini-computer acquisition is planned as an upgrade/replacement for aging equipment in FY 1991. METC peripheral equipment includes 40 disk drives and 9 tape drives. The current level of computing capability at METC is sufficient to support all administrative applications and most engineering and scientific applications, and more advanced processing requirements are met through resource sharing with other research laboratories.

Question: Do you believe that your capital equipment budget is sufficient to meet the needs of the Energy Technology Centers, and other contractors such as the National Laboratories?

Answer: The FY 1991 Capital Equipment budget is sufficient to meet the needs of the Energy Technology Centers, and other contractors such as the National Laboratories. It is consistent with the Department's rebalancing of energy technologies to be supported in FY 1991 and the shift in priorities from pursuing long-term R&D to increased emphasis on near/mid-term R&D. This shift in priorities assumes a reduction in in-house work at the ETCs, and thus a reduced need for capital equipment funds.

Question: Why is it necessary to specify a separate capital equipment line?

Answer: In accordance with DOE Order 2200 - Financial Accounting, the distinction between operating and capital equipment expenditures must be maintained at all levels of procuring, accounting and reporting. As a consequence, a separate budget and reporting classification code (35AA) and budget line item have been established for this purpose.

Question: Could equipment be included in each internal or laboratory project or research area just as well?

Answer: Yes, however, it is preferable to have capital equipment costs separately identified from the R&D accounts.

Question: Is equipment on R&D projects with industry included in the contract?

Answer: Yes, equipment can be included in the contracts. However, the equipment is usually government-owned and contractor-held property and accounted for under Federal/DOE guidelines.

Question: Is equipment used in construction of facilities and R&D projects at the Energy Technology Centers included in the projects themselves?

Answer: In general, if the equipment becomes permanently affixed to real estate and/or is integral to the purpose of the project, funding for the equipment is included in the cost of the project.

Construction

Question: For construction: For the Pittsburgh Program Support Facility your estimate of total costs is $8,691,000 (p. 113). The estimated cost last year was $6,300,000 (p. 460-1990 hearing). What are the reasons for the cost escalation?

Answer: The increase of $2,391,000 from the previous cost estimate of $6,300,000 represents new scope that includes additional third floor office area, brick exterior with foundations, additional support area for conference center and added emergency power and distribution. The increase is based on a completed Title I Architecture and Engineering Report, dated November, 1988.

Question: Is the project on the same schedule as last year?

Answer: The start date for construction, the second quarter, FY 1990, is the same as last year. However, the end date has been extended from fourth quarter, FY 1991, to third quarter, FY 1992.

Question: Can you maintain the schedule with the proposed 1991 funding level?

Answer: The $.689 million requested in FY 1991 will not be sufficient to keep the project on schedule, but reflect an FY 1991 determination to reduce the scope of the project. A total of $2.659 million is needed to keep the project on schedule and to complete the project at a total estimated cost of $8.691 million.

Question: For the Pittsburgh Chemical Engineering Laboratory -- What has been accomplished with the funding to date?

Answer: The status of the facility construction of the PETC chemical engineering laboratory as of December 31, 1989 is as follows:

The architectural and engineering (A&E) work was initiated in the 2nd quarter of FY 1988. Title I design is complete and Title II design is 14% complete.

With the balance of the $1.8 million provided to date, it is planned to complete the demolition work and 100 ft. extension shell.

Question: What additional funds would be necessary to complete the original scope of the project. Describe what that additional work was.

Answer: The total original estimated cost of the project was $4.696 million, of which $0.25 million was funded in FY 1988, $1.25

funded in FY 1989 and $.300 million was funded in FY 1990 for total funding to date of $1.8 million. Additional funds of $2.896 million would be needed to complete the original scope of the project.

The increase of $2.898M over the previous cost estimate of $4.696M represents an expanded scope of work such as increased height of the building extension, demolition of three existing buildings and renovating the south end of an existing building. The increase is based on a completed Title I architecture and engineering report dated March 1989.

Question: For general plant projects provide a list of projects being undertaken in FY 1990 at each location and the remaining backlog of projects, including estimated costs.

Answer: The following is a list of the General Plant Projects being undertaken in FY 1990 and the remaining backlog of essential unprioritized projects with estimated costs that remains unfunded at the end of the year.

General Plant Projects
Morgantown Energy Technology Center
($ in thousands)

FY 1990 Projects	Total Estimated Cost
Exterior Building Covering for B-5,7,8	$ 150
Rem. Cross-Ties & Tie Pit to Cont. Water Sys	170
Replace Elect. Service to B-1, B-25	65
B-19 Office/Support Area & Addl. Dock	454
SUBTOTAL	$ 839
BACKLOG	
Site Survey 132 Acres	50
Child Care Facility	250
Utility Site Assessment	60
Site Energy Management System	750
Renovate High Pressure Compressor System	200
Resurface Site Roadways	500
Primary Power Loop for 45 Acre Site	1,000
Utility Tunnel Phase IV (To B-18)	1,000
Electrical Distribution 86 Acres (Phase 1)	500
Underground Data/Telephone Lines	1,200
Close Settling Pond/Rem. Mercury Cont. Soil	250
Addl. Card Access Secured Areas	100
Utility Tunnel Phase III	400
B-1 Elevator Replacement	200
B-8 Renovation (Pumps & Cooling Tower)	500
Landscaping After Trailer Removal	50
Asbestos Removal-Exterior Lines	50
Expand Central Chiller Facility	400
Install Scrubbers & Stack Filters	200

Reroof Buildings 1-9	1,000
Road Additions 86 Acres	400
Landscape & Storm Drainage 86 Acres	580
Security Lighting 86 Acres	150
Upgrade Fire Protection System	1,000
Replace Condensate Return System	350
Elect. Dist. (Phase II)	450
Replace 45 Acre Fence (5500 LF)	200
Remove Abandoned Underground Utility Lines	400
Potable Water/Fire System Repiping	1,000
Sewer System Repiping	1,000
Parking Lot Expansion	500
Expand Bulk Gas Storage Area	500
SUBTOTAL	$15,190

General Plant Projects
Pittsburgh Energy Technology Center
($ in thousands)

FY 1990 Projects	Total Estimated Cost
Design/Construction Alternate Stream Line from Boiler Plant to R&D Plateau	$ 260
Construct Roofs - Buildings 83 and 58	250
Design/Construct Upgraded Fire Protection Systems (Buildings 64, 83, 92, 99, 900, 902, 903 and 920)	150
Design/Construct Jogging and Physical Fitness Stands Around 2.2 Acre Site and Supply Water/Power/Fencing to 4.1 Acre Site	50
Design/Construct Second Floor Storage Deck in Building 902	50
Design/Construct Office Soundproofing in Building 921	60
Construct Temporary Guard Post for 920 Complex	19
SUBTOTAL	$ 839
BACKLOG	
Upgrade Wallace Road (Base and Drainage) - Approximately 1/2 mile - One of the main access roads to facility	950
Upgrade Parking Area and Roads on R&D Complex - Approximately 1/4 mile of roads (Re-evaluate, new base, resurface)	500
Upgrade Roads on Program Support Area (New base, drainage, resurface)	450
Upgrade Roads on Support Contractor Area (New base, resurface)	350
Upgrade Utilities on R&D Complex (Stream, condensate, hot and cold water, nitrogen, plant air)	550
Upgrade Program Support Facility Site (Pedestrian Mall, Roadways, and Parking)	525

Design/Construct Jogging and Physical Fitness Stands Around 2.2 Acre Site and Supply Water/Power/Fencing to 4.1 Acre Site	50
Design/Construct Second Floor Storage Deck in Bldg. 902	50
Design/Construct Office Soundproofing in Building 921	60
Construct Temporary Guard Post for Building 920 Complex	50
Replace Obsolete Underground Storm Sewers - Building 58	200
Conduct NFPA Evaluation and Compliance Site Audit	75
Conduct NEC Evaluation and Compliance Site Audit	75
Construct Security Fencing Around R&D Plateau Area	175
Construct Closed Loop Overflow System for Process Sewer Sumps - Building 74	250
Construct Entrances and Emergency Egress Exits per Code Requirements - Buildings 83 and 89	50
Construct Conference Room Parking Lot - Building 922	250
Construct Road Salt Storage Shelter - Building 900 Complex	25
Construct Per Code Compliance Stair Tower - Building 58 - for Emergency Egress	150
Utility Renovations - Building 907	200
SUBTOTAL	$ 4,985

General Plant Projects
Bartlesville Project Office
($ in thousands)

FY 1990 Projects	Total Estimated Cost
Modification of Foam System	$ 10
Replace Sprinkler System	8
Emergency Spill Containment	13
Drum Storage System	20
CO/HC Detection System	5
Storage Facility Expansion	40
Software (Material Safety Data Sheets)	3
SUBTOTAL	$ 99
BACKLOG	
Asbestos Removal	$ 175
Replacement of 3 Underground Storage Tanks & Monitoring	100
Roof Repair & Replacement, Bldg. #5 & #6	40
Sidewalk Replacement, Center-wide	20
Paving Repairs	30
Safety/Security System	50
Flood Proofing Bldg. #16	30
Flood Proofing Tank Farm	110
SUBTOTAL	$ 555

Total FY 1990 Projects	$ 1,777
Total Backlog Projects	$20,730

Program Management and Support

Question: For general program costs: Please summarize for the record the amounts in FY 1990 and FY 1991 for technical and management support in each research area, and the major contractors involved.

Answer: The following list reflects the contractors providing Headquarters Technical and Program Management Support as identified in the Key Activity Summaries of the FY 1991 Congressional budget. These contractors provide: technical and engineering studies and analyses that support specific technologies; program briefing materials/fact sheets and charts; topical papers on various technical issues; and data entry and word processing support in the preparation of technical reports and data sheets. It should be noted that some support services to Headquarters are performed by various National Laboratories on an ad hoc basis in the form of technical report assessments, economic forecast evaluations, etc. The Contractors shown are relevant only to FY 1990 since the contractors and associated funding levels are still to be determined for FY 1991.

Program	FY90	FY91 Estimate	Contractors
Control Tech. & Cont. Prep.	$ 576	$ 336	Energetics, Inc., TMSI, Science Mgmt. Corp., Peddada
Adv. Res. & Tech. Devel.	212	192	Energetics, Inc., Peddada, TMSI, PCI, ICF, Resource Dynamics
Coal Liquefaction	271	105	Energetics, Inc., Resource Dynamics, Peddada
Combustion Systems	331	176	Energetics, Inc., Gilbert/ Commonwealth, Peddada
Fuel Cells	380	71	Energetics, Inc., Technology & Management Services, Inc., Gilbert/ Commonwealth
Heat Engines	209	60	TBD
Underground Coal Gasif.	8	4	Joint Venture Organization-II
Magnetohydrodynamics	222	0	Gilbert/Commonwealth
Surface Coal Gasif.	235	85	Energetics, Inc., Gilbert/Commonwealth

Unconventional Gas Recov.	142	97	Joint Venture Organization-II, Technology & Management Services, Inc.
Adv. Extraction & Process Technology	36	116	Energetics, Inc.
Enhanced Oil Recovery	265	171	Joint Venture Organization-II, Technology & Management Services, Inc.
Oil Shale	90	6	Joint Venture Organization-II, TMSI
TOTAL FOSSIL ENERGY TECHNICAL AND PROGRAM MANAGEMENT SUPPORT	$2,977	$1,419	

Question: For the Great Plains Coal Gasification Project about $10.3 million remains in the alternative fuels account to cover liabilities. What liabilities are still outstanding and what is your estimate of their cost?

Answer: The outstanding liabilities stem from litigation initiated prior to or since the sale of the plant. Specific outstanding liabilities and their estimated cost are:

Claimant	For	Estimated Potential Liability or Cost
Shearson Lehman Hutton	contract fee	$ 2.2 million
Equal Employment Opportunity Commission	class action suit	$ 1.0 million
State of North Dakota	unitary taxes	$ 3.0 million
Four pipeline companies	transportation over charges	$ 3.1 million
Morgan, Lewis, Bockius	legal fees	$ 0.5 million
Coastal Corp.	fee, retirement benefits	$ 0.5 million
	Total:	$10.3 million

Question: What has been the operational performance of the Great Plains Project in the past year?

Answer: The current owner, Dakota Gasification Co., a subsidiary of Basin Electric Power Cooperative, is doing an outstanding job of operating the plant. SNG production records have been established throughout the year, by-product production records have been established and plans have been formulated for development of additional by-products. At their annual meeting held in November 1989, Basin Electric announced that Dakota Gasification Co. had made a profit of $35 million in their first year of operation.

Question: For the former Energy Technology Centers Western Research Institute (WRI), National Institute for Petroleum and Energy Research (NIPER), and University of North Dakota Energy and Environmental Research Center (UNDEERC), what is the funding, by program, for FY 1990 and FY 1991?

Answer: The funding for WRI, NIPER and UNDEERC for FY 1990 and FY 1991 is shown in the following chart:

Budget Authority
($ in thousands)

	NIPER		UNDEERC		WRI	
	FY 1990	FY 1991	FY 1990	FY 1991	FY 1990	FY 1991
CT&CP						
Flue Gas Cleanup			0	0		
Waste Management			0	175		
Coal Preparation			0	0		
AR&TD						
Coal Util. Science			592	245		
Tech. Crosscut			178	180		
Liquefaction						
Advanced Research			100	0		
Combustion						
AFB Combustion			98	167	296	
PFB Combustion			148	0		
Alternative Fuels			118	0		
Advanced Research			0	200		
Heat Engines			296	200		
UCG						
Environ. & Adv. Res.					210	216
Gas. Tech. Development					210	245
Surface Coal Gasification						
Advanced Research			99	57	0	
Co-Products			0	0	418	0
Synthesis Gas			309	0	184	
Adv. Ext. & Proc. Tech.	1,036	1,195	879	0	0	0
EOR						
Heavy Oil	395	400				
Light Oil	3,258	3,495				
Oil Shale						
Environ. Mitigation Res.					367	0
Technology Base					641	656

Cooperative R&D			2,340	0	2,291	0
TBD (To be determined)					46	
	4,689a/	5,090	5,157a/	1,224	4,663a/	1,117

a/ Reflects 5% general reduction and 1.3% G-R-H reduction from cooperative agreement funding.

Question: What is the status of the cooperative research program set up with WRI and UNDEERC?

Answer: The FY 1990 plans for the Jointly Sponsored Research Programs (JSRP) submitted by each of the two institutes for funding under the Cooperative R&D budget category have been approved and the individual cost shared tasks proposed in those plans are being further developed and put in place.

As of April, 5 tasks were in place under the WRI JSRP effort, representing a total DOE cost-share of $660,005, or 28% of the FY 1990 funding available under the WRI JSRP, while 6 tasks representing a DOE share of $779,899, or 33% of the available funding were in place under the UNDEERC JSRP effort.

Question: What projects have been funded at each center to date?

Answer: The following tables list the projects funded as of April at the two centers under the Cooperative R&D budget category:

Western Research Institute

Project	DOE Share	Participant Share
Occidental Oil Shale Program Support	$173,767	$181,818
ROPE Process Performance	$ 45,500	$ 45,458
Hazardous Waste Stabilization	$ 55,068	$ 55,058
CHARFUEL Process Product Optimization	$228,214	$241,246
Cold Flow Injector Mixer	$157,456	$157,490

University of North Dakota Energy
and Environmental Research Institute

Project (participant)	DOE Share	Participant Share
Pulse Jet Baghouse Performance Improvement	$139,172	$139,175
Wilsonville PDU Support Study	$ 50,000	$ 50,000
Mild Gasification Instrumentation Development	$ 89,727	$ 90,609
Fractional Dimensional Analysis of Char Combustion	$ 20,000	$ 20,000
CO/Ethanol Desulfurization, II	$125,000	$125,000
GRI Groundwater Research; Phase I and II	$356,637	$357,908

Environmental Restoration

Question: In environmental restoration: Is the $500,000 for the Rockwell International site cleanup the entire DOE liability or will it require future funding?

Answer: In the FY 1991 Congressional budget request, $532,000 has been requested for the Rockwell International site cleanup. This amount is the current estimate to conduct the site cleanup; however, we cannot be certain that it will cover the entire liability until the actual assessment is completed.

General

Question: Please provide, by program, the funds required to retain the employment floors required by law in 1991.

Response: The following information represents the funds that would have to be added to the budget if the FY 1990 mandated personnel floors were to be retained in FY 1991.

Preliminary Analysis of Funding Required to Maintain Personnel Floors

Program Activity	Congressional Floor FTEs	FY 1991 Budget Request FTEs	Delta FTEs	Approximate Delta Cost Restore Floors ($000)
Direct				
CT&CP	65	54	-11	$ +510
AR&TD	50	44	- 6	+278
Coal Liquefaction	32	26	- 6	+278
Combustion Systems	32	29	- 3	+139
Fuel Cells	1	1	0	0
Heat Engines	12	11	- 1	+46
Underground Coal Gas.	0	0	0	0
MHD	0	0	0	0
Surface Coal Gas.	14	13	- 1	+46
AEPT	0	0	0	0
EOR	9	0	- 9	+469
Oil Shale	2	0	- 2	+104
UGR	15	15	0	0
Total Direct	232	193	-39	$+1,870
Indirect				
Program Direction:				
Headquarters	129	123	- 6	$ +426
Field				
METC	178	152	-26	+1,410
PETC	155	127	-28	+1,519
BPO	15	17	+ 2	-109
Metairie	6	5	- 1	+54
Total Field	354	301	-53	$+2,874
Total Indirect	483	424	-59	$+3,300
TOTAL FER&D	715	617	-98	$+5,170

Question: Please provide a compilation of internal R&D, by program, at each of the PETC and METC organizations in FY 1990 and FY 1991.

Answer: The amounts of internal R&D, by program, at PETC and METC for FY 1990 and FY 1991 are reflected in the following chart.

In-house R&D Funds
Budget Authority
($ in thousands)

	FY 1990		FY 1991	
	METC	PETC	METC	PETC
Coal Tech. & Coal Prep.	$ 3,857	$ 6,546	$ 4,382	$ 5,500
Adv. Res. & Tech. Devmt.	1,331	709	1,266	850
Coal Liquefaction	0	4,740	0	2,203
Combustion Systems	1,825	3,592	1,320	3,404
Fuel Cells	198	0	44	0
Heat Engines	3,067	0	1,235	0
Underground Coal Gas.	40	0	0	0
Magnetohydrodynamics	0	0	0	0
Surface Coal Gasification	4,181	0	3,447	0
Unconventional Gas Recovery	1,866	0	542	0
Adv. Ext. & Process Tech.	0	0	0	0
Enhanced Oil Recovery	888	0	0	0
Oil Shale	1,087	0	0	0
Total	$18,340	$15,587	$12,236	$11,957

Question: For the record, update charts through FY 1991 which show: a) allocation of funding to in-house overhead, in-house R&D, "defederalized" energy technology centers, national laboratories, other Federal agencies, universities, and industry, by major activity as shown in last years hearing:

Answer: The following chart, Distribution of Fossil Energy R&D Funds, provides, by major activity, the amounts in FY 1989 (actual), FY 1990 (estimate) and FY 1991 (request) for the following categories: in-house overhead, in-house R&D, "defederalized" energy technology centers, national laboratories, other Federal agencies, universities, and industry. The FY 1989 funding information is consistent with the B&R structure used in executing the FY 1989 budget.

DISTRIBUTION OF FOSSIL ENERGY R&D
FY 1990 BUDGET AUTHORITY
OPERATING EXPENSES ($000)

	CTCP	ARTD	LIQUE	COMB	FC	HE	UCG	MHD	SGASIF	UGR	AEPT	EOR	SHALE	PD	TOTALS 1/
IN-HOUSE OVERHEAD	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$66,158	$66,158
IN-HOUSE R&D	10,403	2,040	4,740	5,417	198	3,067	40	0	4,181	1,866	0	888	1,087	0	33,927
"DEFEDERALIZED" ENERGY TECHNOLOGY CENTERS	0	770	99	760	0	296	420	0	1,009	0	1,915	3,653	1,008	0	9,930
NATIONAL LABORATORIES	3,016	11,498	3,307	701	1,121	75	0	642	987	790	99	3,481	3,257	0	28,974
OTHER FEDERAL AGENCIES	95	10	0	0	0	140	0	0	361	496	0	0	0	2,080	3,182
UNIVERSITIES	2,022	6,204	1,906	2,463	0	15	0	99	2,320	4,175	849	3,214	50	0	23,317
INDUSTRY	42,079	5,868	24,474	23,836	36,680	17,349	355	39,626	14,570	7,102	690	16,110	3,612	0	232,351
TOTAL	$57,615	$26,390	$34,526	$33,177	$37,999	$20,942	$815	$40,367	$23,428	$14,429	$3,553	$27,346	$9,014	$68,238	$397,839 2/

1/ THIS IS AN ESTIMATE WHICH INCLUDES THE G-R-H REDUCTION AND IS SUBJECT TO CHANGE. THERE IS AN ADDITIONAL $4,631,000 FUNDING FOR THE "DEFEDERALIZED" ENERGY TECHNOLOGY CENTERS IN THE COOPERATIVE R&D PROGRAM.

2/ ENVIRONMENTAL RESTORATION OF $1,029,000 NOT INCLUDED.

DISTRIBUTION OF FOSSIL ENERGY R&D
FY 1991 REQUEST
OPERATING EXPENSES ($000)

	CICP	ARTD	LIQUE	COMB	FC	HE	UCG	MHD	SGASIF	UGR	AEPT	EOR	SHALE	PD	TOTALS
IN-HOUSE OVERHEAD	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$29,639	$29,639
IN-HOUSE R&D	9,882	2,116	2,203	4,724	44	1,235	0	0	3,447	542	0	0	0	0	24,193
"DEFEDERALIZED" ENERGY TECHNOLOGY CENTERS	175	425	0	367	0	200	461	0	57	0	1,350	3,895	656	0	7,586
NATIONAL LABORATORIES	1,250	10,666	1,448	112	498	0	0	0	400	498	2,159	1,790	0	0	18,821
OTHER FEDERAL AGENCIES	98	0	0	0	0	175	0	0	150	0	0	0	0	2,185	2,608
UNIVERSITIES	1,310	5,467	519	0	0	0	0	0	180	1,487	165	858	0	0	9,986
INDUSTRY	20,814	7,814	6,453	12,420	6,540	4,433	4	0	4,251	11,147	9,256	20,562	6	0	103,700
TOTAL	$33,529	$26,488	$10,623	$17,623	$7,082	$6,043	$465	$0	$8,485	$13,674	$12,930	$27,105	$662	$31,824	$196,533 1/

1/ ENVIRONMENTAL RESTORATION OF $712,000 NOT INCLUDED.

DISTRIBUTION OF FOSSIL ENERGY R&D
FY 1989 BUDGET AUTHORITY
OPERATING EXPENSES ($000)

	CTCP	ARTD	LIQUE	COMB	FC	HE	UCG	MHD	SGASIF	UGR	APT	EOR	SHALE	PD	TOTALS
IN-HOUSE OVERHEAD	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$62,494	$62,494
IN-HOUSE R&D	9,584	2,172	3,680	4,475	100	3,069	0	0	4,122	1,577	27	986	1,209	0	31,001
"DEFEDERALIZED" ENERGY TECHNOLOGY CENTERS	1,445	258	663	1,608	0	334	1,171	0	1,279	0	1,533	4,800	2,839	0	15,930
NATIONAL LABORATORIES	3,610	12,233	2,838	1,215	1,630	160	133	600	1,800	550	1,423	3,345	3,400	0	32,937 1/
OTHER FEDERAL AGENCIES	90	47	70	320	0	200	0	0	417	352	28	0	345	1,824	3,693
UNIVERSITIES	4,056	7,955	3,795	967	362	461	0	188	1,537	2,907	875	6,105	196	259	29,663
INDUSTRY	30,142	2,899	21,343	18,111	24,442	18,034	67	36,212	12,402	5,998	315	8,347	2,541	0	180,853
TOTAL	$48,927	$25,564	$32,389	$26,696	$26,534	$22,258	$1,371	$37,000	$21,557	$11,384	$4,201	$23,583	$10,530	$64,577	$356,571

1/ INCLUDES $400,000 TO ANL AS A SUBCONTRACTOR TO ALLIED SIGNAL CORP.

Question: For AR&TD, the same as a) above, but separating METC and PETC.

Answer: The FY 1989, FY 1990 and FY 1991 funding profiles for AR&TD follow:

Budget Authority
($ in thousands)

	FY 1989	FY 1990	FY 1991
In-house R&D (METC)	$ 1,342	$ 1,331	$ 1,266
In-house R&D (PETC)	830	709	850
"Defederalized" Energy Technology Centers	258	770	425
National Laboratories	12,233	11,498	10,666
Other Federal Agencies	47	10	0
Universities	7,955	6,204	5,467
Industry	2,899	5,868	7,814
Total	$ 25,564	$26,390	$26,488

Question: By major activity, how much is provided for acid rain related research in fiscal years 1989 through 1991?

ANSWER: The acid rain related research, by major activities and fiscal year, is as follows:

	FY 1989	FY 1990	FY 1991
FE National Acid Precipitation Assessment Program (NAPAP)	$ 970	$ 820	$ -0-
Control Technology & Coal Preparation	48,927	57,615	33,529
AR&TD Coal Utilization Science	3,691	4,121	3,283
Combustion Systems	26,696	33,177	17,623
Surface Coal Gasification (Sys. for Power Prod. & Sys. for industrial Fuel Gas Prod.)	6,774	7,237	3,698
TOTAL FE R&D	$ 87,058	$102,970	$ 58,133
Clean Coal Technology	$173,800	$531,452	$431,000

FE Indirectly Related Research

Surface Coal Gas., Other	$ 14,783	$ 16,191	$ 4,787
Fuel Cells	26,534	37,999	7,082
Heat Engines	22,258	20,942	6,043
MHD	37,000	40,367	-0-
TOTAL	$100,575	$115,499	$ 17,912
GRAND TOTAL	$361,433	$749,921	$507,045

Question: For national laboratories, please show funding for each laboratory by activity for FY 1989, FY 1990, and projected for FY 1991.

Answer: The following table shows funding for each national laboratory by activity for FY 1989, FY 1990 and projected FY 1991.

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Ames Laboratory:			
Control Technology and Coal Prep.	1,240	0	0
Advanced Research and Tech. Devmt.	60	74	49
	1,300	74	49
Argonne National Laboratory:			
Control Technology and Coal Prep.	920	908	650
Advanced Research and Tech. Devmt.	3,356 1/	3,312 1/	2,139
Coal Liquefaction	30	30	0
Combustion Systems	755	745	0
Fuel Cells	1,185 2/	1,170	498
Heat Engines	150	148	0
Magnetohydrodynamics	600	592	0
Surface Coal Gasification	150	148	100
Program Direction & Mgmt. Support	2	2	0
	7,148	7,055	3,425
Brookhaven National Laboratory:			
Advanced Research and Tech. Devmt.	115	160	0
Combustion Systems	100	0	112
Surface Coal Gasification	300	247	100
Enhanced Oil Recovery	385	434	440
	900	841	652
Hanford Engineering Development Laboratory:			
Advanced Research and Tech. Devmt.	50	106	127

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Idaho National Engineering Laboratory:			
Control Technology and Coal Prep.	240	0	0
Advanced Research and Tech. Devmt.	1,597	1,508	1,876
Advanced Extraction & Process Tech.	250	0	500
Enhanced Oil Recovery	1,000	0	0
	3,087	1,508	2,376
Lawrence Berkeley Laboratory:			
Control Technology and Coal Prep.	510	494	400
Advanced Research and Tech. Devmt.	250	247	200
Coal Liquefaction	50	0	0
Combustion Systems	10	0	0
Heat Engines	10	0	0
Surface Coal Gasification	400	296	0
Advanced Extraction & Process Tech.	48	0	0
Enhanced Oil Recovery	300	296	300
	1,578	1,333	900
Lawrence Livermore Laboratory:			
Advanced Research and Tech. Devmt.	395	390	200
Combustion Systems	150	148	0
Underground Coal Gasification	133	0	0
Surface Coal Gasification	800	296	0
Unconventional Gas Recovery	250	247	0
Enhanced Oil Recovery	560	580	350
Oil Shale	3,000	2,961	0
	5,288	4,622	550
Los Alamos National Laboratories:			
Advanced Research and Tech. Devmt.	380	295	260
Fuel Cells	185	148	0
Advanced Extraction & Process Tech.	317	0	0
Enhanced Oil Recovery	398	197	150
Unconventional Gas Recovery	250	247	0
	1,530	888	410
Oak Ridge National Laboratory:			
Control Technology and Coal Prep.	700	594	200
Advanced Research and Tech. Devmt.	4,695	4,408	4,115
Coal Liquefaction	300	296	150
Surface Coal Gasification	150	148	200
	5,845	5,446	4,665
Pacific Northwest Laboratory:			
Control Technology & Coal Prep.	0	298	0
Advanced Research and Tech. Devmt.	300	396	400
Coal Liquefaction	150	0	0
Combustion Systems	50	0	0
Fuel Cells	260	257	0
Unconventional Gas Recovery	50	0	0
	810	951	400

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Sandia National Laboratories:			
Advanced Research and Tech. Devmt.	1,160	1,170	1,000
Coal Liquefaction	2,308	2,789	1,198
Combustion Systems	150	0	0
Advanced Extraction & Process Tech.	808	99	1,099
Enhanced Oil Recovery	702	493	550
Oil Shale	400	296	0
Unconventional Gas Recovery	0	296	498
	5,528	5,143	4,345

1/ Includes $125K to ANL as a subcontract through Westinghouse.
2/ Includes $400K to ANL as a subcontract through Allied Chemical.

Question: For fiscal year 1989 provide data which shows the amount of foreign travel versus domestic travel.

Answer: The total travel obligation for fiscal year 1989 was $1,747,643, as follows:

Domestic - $1,556,786
Foreign - $ 187,857

Question: Please explain what TMSI and PEDDADA in Headquarters Program Direction are.

Answer: TMSI and PEDDADA are Headquarters support service contractors who perform management and administrative functions. These functions and planned obligations for FY 1990 are as follows:

TMSI - Provides general management/administrative support including maintenance of FE systems, data reconciliation, graphics support, and program analysis/administrative support. ($1,092,524)

PEDDADA - Supports FE's Business Management Information System (BMIS) and other DOE information systems in the following areas: data management, data entry and analysis; data collection; data report preparation; and data document preparation. ($526,454)

Question: For the major activities within the individual coal programs please provide time charts showing the funding and time necessary to complete funding, using the assumption that Congressional intent in FY 1990 was to fund all activities to full completion, including multiple contractors.

Answer: Charts showing the funding and time necessary to conduct all major activities within the individual coal programs to full completion based on Congressional intent in FY 1990 are as follows:

Coal Preparation Program
Major Activities
($000)

Activity	FY 1989	FY 1990	FY 1991	Req. to Complete
ACID RAIN ABATEMENT				
o Clean Coal Research Initiative	Level 1 ▲ $4580	$7097	Level 2 $7900	▼ ■ ■ 12/92 $4000
o DOE/EPRI Cooperation at Homer City CQDC	$2000	Level 2 ▼1 ▲2 $2639	0	■ ■ 10/92 ▼3 0
OIL BACKOUT				
o PETC Hi-Bay		▲ $ 493	0 ($1000)*	■ ■ ■ ■ ■ Continuing TBD
o Physical/Chemical/Biological/Ancillary	$3619	$2253	$1668 ($3275)*	■ ■ ■ ■ ■ Continuing TBD
CHEMICAL COAL CLEANING				
o Molten Caustic Leaching-Gravimelt	$1300	Level 1 $1974	0	▼4 ■ ■ 7/92

Level 1 is bench-scale testing up to 500 lb/hr.

Level 2 is proof-of-concept scale scale testing - 1 to 3 tons/hr.

▲ Begin
▼ Complete

1. Complete Bechtel selective Agglomeration System
2. Initiated Procurement for New Concepts
3. Complete Testing New Concepts
4. Compile Integrated Testing and evaluation of TRW MCL

* Total required in FY 1991 to maintain schedule

Flue Gas Cleanup

Major Activities
($000)

Program Activity	FY1989	FY1990	FY1991	Required To Complete
Adv. Compliance				
NOXSO (M-K Ferguson)	POC Testing 2000	889	0	■ ■ ■ ▼ 10/92 500
DIET Proc. Dev. (Cottrell)	POC Testing 0	1524	0	■ ■ ■ ■ ■ ▼ 10/93 1304
Copper Oxide Proc (UOP)	POC Testing 1590	0	0	■ ■ ■ ■ ■ ▼ 10/93 4971
TUNG Process (Raycon)	Bnch Sc. 1	▲▼ 957	POC 164 (2514)*	■ ■ ■ ■ ■ ▼ 10/93 425
Adv. NOx Control POC (TBD)	POC Testing 302	1775	400 (600)*	■ ■ ■ ▼ 10/92 500
Acid Rain				
Duct Injection Scaleup (Gilb. Common.)	System Integration 4095	3489	2290	■ ■ ■ ▼ 10/92 365
Duct Injection Fund. Investig. (Radian)	Pilot Scale Tests 401	509	145	■ ■ ■ ▼ 10/92 0
Duct Injection Prototype Dev. (UEC)	System Integration 916	1431	600 (1300)*	■ ■ ■ ▼ 10/92 0
Hi Sulfur Test Center (EPRI)	POC Testing 200	197	200	■ ■ ■ ▼ 10/92 200
Super Clean				
Advanced Sep. Pilot Test (TBD)	▲ Pilot Sc. Testing 106	691	200	■ ■ ■ ■ ■ ▼ 10/94 3000
Fine Particulate Pilot Test. (TBD)	0	▲ Pilot Scale Testing 238	483	■ ■ ■ ■ ■ ▼ 10/94 1296
Air Toxics (TBD)	0	▲ Analysis & Develop. 196	0	■ ■ ■ ■ ■ ■ 10/94+ 2750
CO2 CONTROL (GLOBAL WARMING)				
(TBD)	0	Assess., Eval. & Devel 0	▲ 50 (150)*	■ ■ ■ ■ ■ ■ 10/94+ 3750

▲ Start Activity
▼ Complete Activity
*( ) Total $ required in FY 1991 to maintain schedule

GAS STREAM CLEANUP PROGRAM
MAJOR ACTIVITIES
($1,000)

Activities	FY89	FY90	FY91	Req to Complete
DOE/Ind. Particulate Fac.	600	4,935	500 (6,500) *	▼ 12/95 24,321
METC HGCU Gasifier	2,109	2,467	2,470 (2,470) *	▼ 12/96 22,000

* ( ) Total $ requirement in FY1991 to maintain schedule

Pressurized Fluidized Bed Program
Major Activities
($000)

Activity	FY 1989	FY 1990	FY 1991	Req. to Complete
Advanced Concepts o Foster Wheeler	Phase 2 $4145	$4342	$5100	Phase 3 ▼ 5/93 $4000
First Generation o Hot Gas Cleanup - AEP	▲ $2002	$5922	$1401 (5900)*	▼ 1/94 $8200

▲ Begin ▼ Complete

* Total required in FY 1991 to test two devices

AFB PROGRAM
MAJOR ACTIVITIES
($000)

ACTIVITY	FY 1989	FY 1990	FY 1991	REQ. TO COMPLETE
ADVANCED CONCEPTS				
o Vortex FBC - Donlee (Y-S)	Level 2 $350	▲▼ $14	Level 3 0	■ ■ ■ ■ ▼ 9/92 0
o Multi-Solid FBC (Riley Stoker)	$373	1 ▼0▲ Level 2 $494	Level 3 ▲▼ $402 ($500)*	■ ■ ■ ■ ■ ▼ 12/92 $100
SPECIAL APPLICATIONS				
o CLOSED CYCLE FBC -EER (Formerly Air Cooled)	Level 2 $319	▲▼Level 3 $103	▲▼ Level 4 0	■ ■ ■ ▼ 6/92 0
o Pulsed FBC - MTCI Level 1 & 2 Level 3 TBD	Level 2 ▲ $141	▲▼ $251	Level 3 $0 ($1200)*	■ ■ ■ ▼ 6/92 $0
o Hospital Waste - Good Samaritan (FY89) Phase II TBD Req $50% Cost Sharing (FY 90 & 91)	Phase I $475	▲▼ $1164	Phase II $286	■ ■ ■ ■ ■ ▼ 8/93 $TBD

Advanced Concepts
Level 1 - Feasibility Study
Level 2 - Bench-scale Study
Level 3 - Proof-of-Concept

Special Applications
Level 1 - Feasibility Study
Level 2 - Sub-system Dev.
Level 3 - Subsystem Integr.
Level 4 - Proof-of-Concept

* Total required in FY 1991 to maintain schedule ▲ Begin ▼ Complete
1. Decision to go to level 2 or continue in special applications.
2. Decision to go to level 2 of Advanced Concepts.

Waste Management
Major Activities
($000)

Activity	FY 1989	FY 1990	FY 1991	Req. to Complete
Field Site Study - Radian	▲1 $ 731	▲2 $ 753	▲3 $1223	▼4 9/94 0

▲ Begin ▼ Complete

1 - Initiate monitoring at Lorain, OH, and Nucla sites
2 - Initiate monitoring at Canton, IL, site
3 - Initiate monitoring at 4th site
4 - Completion of monitoring

Advanced Combustion Program
Major Activities
($000)

Activity		FY 1889	FY 1990	FY 1991	Req. To Complete
Industrial	Phase I & II	$2854	1 $1893	▼4 $ 18	
	Phase III		2▲ $ 691	▼3 $ 578 (722)*	▼5 8/94 $7000
Small-Scale	Phase I & II	1 $1215	▼3 0		
	Phase III	2 $1000	▲ $ 987	▼4 $1000	▼5 2/94 $1500
Utility/Combustion 2000					
	Low-Emissions Boiler		▲1 $ 497	▼2 $ 500 (1150)*	▼3, 12/98 $74000
	High-Performance Power System		1▲ $ 490	▼2 $ 500 (1150)*	3▼ 12/98 $54000

▲ Begin ▼ Complete

* Total required in FY 1991 to maintain schedule

Industrial

1. Decision on Phase III - Start 10/89
2. Phase III Solicitation - 3/90
3. Award Phase III Contracts - 9/90
4. Phase II Completion - 3/91
5. Phase III Completion - 8/94
4. Phase II Completion
5. Phase III Completion - 8/94

Small-Scale

1. Decision on Phase III - Start 1/89
2. Phase III Solicitation - 11/89
3. Phase II Completion - 9/90
4. Award Phase III Contracts - 8/90
5. Phase III Completion - 2/94

Phase I - Combustor design, verification testing
Phase II - Performance testing of combustor
Phase III - POC development and testing

Combustion 2000	LEBS	HPPS
1. Solicitation, Phase I	5/90	7/90
2. Begin Phase I	2/91	4/91
3. End Phase II	12/98	12/98

Phase I (LEBS) - Concept dev. & eng. dev.
(HPPS) - Concept eval. & definition
Phase II - POC

Alternative Fuels Program
Major Activities
($000)

Activity	FY 1989	FY 1990	FY 1991	Req. To Complete
Fuel/Combustion Characterization	▲1 $1768	$1824	$ 247 ($1500)*	▼2 4/96 $1700
Fuel Logistics		▲3 $1086	$ 604	▼4 12/94 $1000
SCCW's Boiler Comb. Tests				
Water Tube (U.S. DOE/Italy)	$160**	▲5 $1480	▲6 0	▼7,8 9/93 0
Fire Tube		▲ $ 395	0 ($600)*	▼8 9/93 $1605
Reburning (Niles Station)		$2490	▲9 0	▼10 9/93

▲ Begin ▼ Complete
* Total required in FY 1991 to maintain schedule
** FY 1989 funding also under AR&TD

1. Initiate coal-fuel characterization - 3/89
2 - Complete POC end-use testing - 4/96
3 - Initiate fuel logistics bench-scale R&D - 9/89
4 - Complete system testing for logistics - 12/94
5 - Complete system testing for logistics - 12/94
6 - Initiate DOE/Italy cooperative SCCWS combustion testing - 8/89
7 - Initiate fire-tube combustion testing of SCCWS fuels - 9/90
8 - Complete DOE/Italy program - 9/93 13- Complete fire-tube testing - 9/93
9 - Initiate gas reburning project - 9/90
10- Complete gas reburning project - 9/93

SURFACE COAL GASIFICATION PROGRAM
MAJOR ACTIVITIES
($1,000)

Activities	FY89	FY90	FY91	Req to Complete
Texaco Hot Gas Cleanup	1,426	2,369	1,361 (2,300) *	5/93 2,500
GE Hot Gas Cleanup	2,203	1,184	500 (500)*	4/92 0
1 TPD Mild Gasification	0	2,961	1,000 (6,000) *	8/93 9,739

* ( ) Total $ requirement in FY1991 to maintain schedule

HEAT ENGINES PROGRAM
MAJOR ACTIVITIES
($1,000)

ACTIVITIES	FY89	FY90	FY91	Req to Complete
COAL FUELED GAS TURBINES (Three Contractors)	9,013	5,751	2,119 (7,600) **	6/94 9,000
COAL FUELED DIESEL ENGINE (Three Contractors)	8,490	8,756	2,429 (5,200) **	3/93 8,100

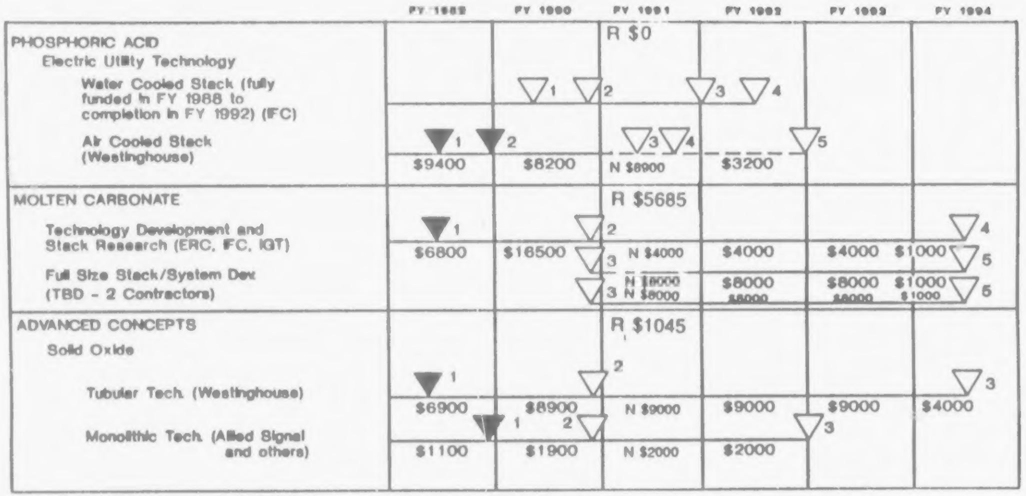
** ( ) Total $ requirement in FY1991 to maintain schedule

COAL LIQUEFACTION
MAJOR ACTIVITIES
($1,000)

ACTIVITIES	FY89	FY90	FY91	Req to Complete
DIRECT LIQUEFACTION PETC GENERIC UNIT	1,000	1,480	0 (2,300)	■ ■ ■ ■ 9/92 * 2,000
INDIRECT LIQUEFACTION PETC GENERIC UNIT	1,000	1,480	0 (2,000)	■ ■ ■ ■ 9/92 * 1,020

* ( ) Total $ requirement in FY1991 to maintain schedule

MAJOR ACTIVITIES IN FUEL CELL SYSTEMS DEVELOPMENT ($ IN THOUSANDS)



Codes: ▼ = Actual Completion, ▽ = Planned Completion, R = FY91 Request, N = Additional Funding Needed in FY 91

PHOSPHORIC ACID
Electric Utility, Water Cooled Stack:
1 Complete Configuration "B" development stack design (03/90)
2 Start 1500 hour test of first 10 square foot Configuration "B" stack (08/90)
3 Complete assembly of third and final 10 square foot "B" stack; ready for test by EPRI (10/91)
4 Complete advanced cell and stack development contract (Configuration "B")(04/92)

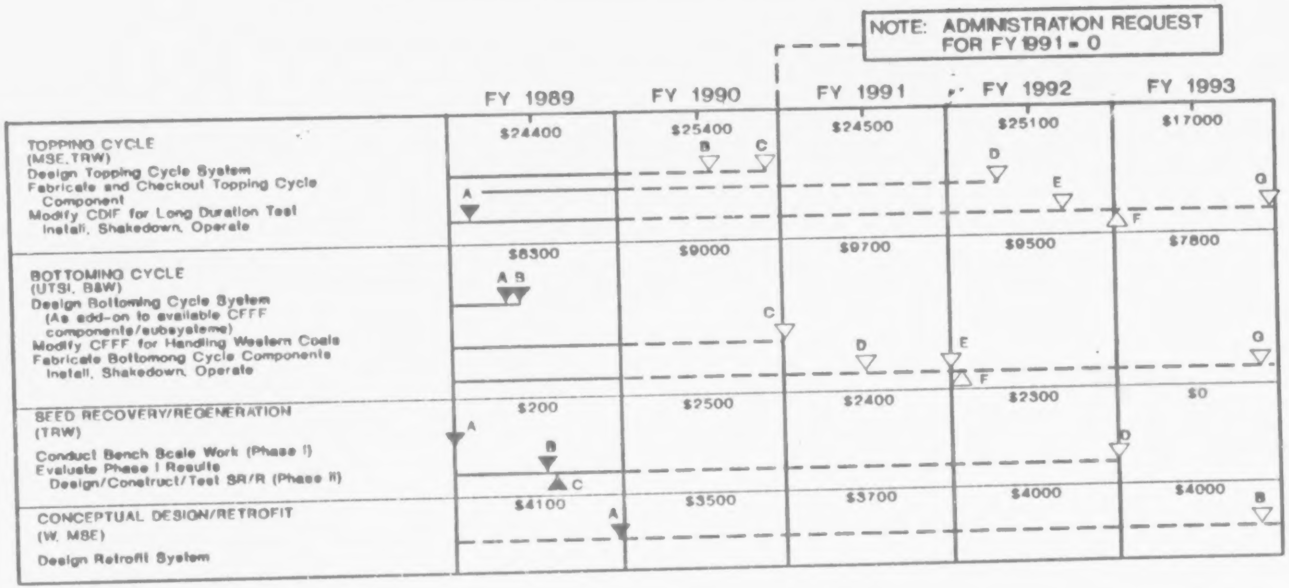
Electric Utility, Air Cooled Stack:
1 Completed performance test of [illegible] kW stack (07/89)
2 Completed design of engineering model 375 kW model (10/89)
3 Complete fabrication of engineering model 375 kW module (03/91)
4 Complete testing of engineering model 375 kW module (06/91)
5 Complete testing of 375 kW modules (09/92)

MOLTEN CARBONATE
1 Complete system analyses and comparisons with completing systems (04/89)
2 Complete three development contracts to resolve identified system deficiencies and continue on stack research contract (09/90)
3 Initiate full size stack/system development for coal fueled power plants (09/90)
4 Completion of technology development support on critical problems and alternative technologies (04/94)
5 Full size stack tests completed (04/94)

ADVANCED CONCEPTS
Solid Oxide, Tubular Technology:
1 Initiate 5 year technology and cost improvement contract on tubular solid oxide (04/89)
2 Complete test of first 20 kW tubular solid oxide generator (09/90)
3 Complete 5 year technology and cost improvement effort on tubular solid oxide and decision on further development (04/94)

Solid Oxide, Monolithic Technology:
1 Award development contract for monolithic solid oxide (09/89)
2 Test multi-cell units (09/90)
3 Complete monolithic cell development (09/92)

MAGNETOHYDRODYNAMICS
($ IN THOUSANDS)



NOTE: ADMINISTRATION REQUEST FOR FY 1991 = 0

	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993
TOPPING CYCLE (MSE, TRW) Design Topping Cycle System Fabricate and Checkout Topping Cycle Component Modify CDIF for Long Duration Test Install, Shakedown, Operate	$24400	$25400	$24500	$25100	$17000
BOTTOMING CYCLE (UTSI, B&W) Design Bottoming Cycle System (As add-on to available CFFF components/subsystems) Modify CFFF for Handling Western Coals Fabricate Bottomong Cycle Components Install, Shakedown, Operate	$8300	$9000	$9700	$9500	$7800
SEED RECOVERY/REGENERATION (TRW) Conduct Bench Scale Work (Phase I) Evaluate Phase I Results Design/Construct/Test SR/R (Phase II)	$200	$2500	$2400	$2300	$0
CONCEPTUAL DESIGN/RETROFIT (W, MSE) Design Retrofit System	$4100	$3500	$3700	$4000	$4000

TOPPING CYCLE MILESTONES

A. Upgrade Coal and Seed Transfer System - 1/89
B. Critical Design Review (CDR) - 6/90
C. Complete Design Prototype Hardware - 9/90
D. Ship Prototype Hardware to CDIF - 3/92

E. Prototype Hardware Installed at CDIF - 6/92
F. Initiate Long Duration Testing at CDIF - 10/92
G. Complete Long Duration Testing at CDIF - 9/93

BOTTOMING CYCLE MILESTONES

A. Critical Design Review (CDR) Add-on Components - 2/89
B. Bottoming Systems Design Complete - 3/89
C. Modification of CFFF to Handle Western Coal Complete - 10/90

D. Bottoming Systems Components Fabricated/Installed - 3/91
E. Bottoming Cycle Shakedown/Acceptance - 10/91
F. Commence Western Coal Studies - 11/91
G. Complete Bottoming Cycle Testing - 9/93

SEED RECOVERY/REGENERATION MILESTONES

A. Complete Phase I (Bench-Scale) - 10/88
B. Select Phase II Contract - 4/89
C. Commence Phase II of SR/R Effort - 5/89
D. Phase II SR/R Contract Co[illegible]te - 9/92

RETROFIT CONCEPTUAL DESIGN MILESTONES

A. Conceptual Design Complete - 9/89
B. Update Design - 9/93

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Fuels Programs

Question: The bulk of your activity appears to be in the natural gas import and export program. Is the workload increasing?

Answer: Yes the workload in the natural gas import/export program is increasing. There has been a steady increase in the number of applications filed each year since 1984 when the number doubled to 20. In 1989 there were 90 applications submitted. Further, the type of application filed has been changing. A growing percentage of the applications filed relate to projects that are long-term and involve new construction. This type of application creates a greater workload.

Question: Is it expected to increase in 1991?

Answer: Yes. In 1991 it is estimated that the program will process between 100 and 140 applications, at least half of which will be for long-term authorizations that will involve new construction.

Question: How long does it take to process an average application in FY 1990?

Answer: As indicated above there are actually two types of applications. For a short-term import application the office requires approximately 130 days. A long-term authorization request requires approximately 260 days.

Question: Based on projected 1991 workload and personnel will that time increase in 1991? If so, by how much?

Answer: It is anticipated that the average time required to process an application will increase. The processing time for short-term applications will probably remain the same but the time for long-term applications will increase from 260 days to 285 days.

Question: How many additional personnel would be necessary to keep the time the same as 1990?

Answer: At least two additional FTEs would be required to maintain the same processing rate as the past. However, new Departmental environmental requirements may increase the processing time even with an increased staffing level.

Question: Contract support for Environmental Impact statements is decreased in 1991. Will this also increase processing time? If so, by how much?

Answer: The reduction in contractor support should not increase processing time. The Federal Energy Regulatory Commission (FERC) has the responsibility for the preparation of environmental impact statements (EIS) relating to gas import projects as long as the gas moves through new interstate gas pipelines. The Department serves as a cooperating agency for these EIS's, and thus far contractor support has not been required for this effort.

However, certain export or import applications do not involve FERC authorization and for these cases the Department must produce its own EIS. Where the Department has the responsibility for producing an EIS, any lack of funds for contractor support would force a delay in the proceeding into the next fiscal year when new funds would be available.

Question: How much additional funding would be required to keep processing time about the same as 1990?

Answer: Since current indications are that there will be no additional requirements for the preparation of EISs no additional funding will be required above that necessary to support any additional FTEs allocated to the program.

Question: What is the practical effect of delaying these applications?

Answer: A delay in processing can result in: a delay in the start-up of a cogeneration unit and the resultant loss of power generation; delays in delivery of gas to a local distribution company; cancellation of projects whose financing depended upon government approval by a date certain; cancellation of gas purchase contracts, such as those serving the gas supplies to be transported over the proposed Iroquois pipeline, and the resultant renegotiation of those contracts at probable higher prices for U.S. consumers; and loss of gas service to areas of the country whose sole source of gas is an imported supply.

Question: Please explain how staff can increase from 25 to 29 in FY 1991 while costs decrease?

Answer: In February 1989, the Fuels Program was transferred to the Office of Fossil Energy from the Economic Regulatory Administration with 29 FTEs on-board and FY 1990 funds were appropriated as requested for the 29 FTEs. During the development of the FY 1991 budget request, the FTE allocation resulted in a reduction of 4 FTEs to the Fuels Program for FY 1990 which does not represent the on-board staffing. As a consequence, the total funding is correct in the FY 1990 column of the FY 1991 budget request but the cost per FTE is overstated. However, it should be noted that no precipitous action will be taken to reduce on-board staffing. Further, a review of the FY 1991 column indicated that the requested funding is sufficient for 29 FTEs.

Question: Is the workload in the electricity program increasing, also?

Answer: Yes. Until recently, the Office of Fuels Programs worked on an average of 1 to 2 Presidential permits and/or electricity export applications per year. Over the past two years, the Office has worked on an average of 6 permits and/or export applications.

Question: Describe the nature of the increases.

Answer: The workload in the electricity program has increased in both volume and complexity. As indicated in the previous response, the volume of Presidential permit and electricity export applications has increased three-fold over the past several years. In addition, the higher electrical capacities of the newly proposed international transmission lines create more complex electric reliability issues which impact a greater number of regional utilities.

Also, the Department's renewed commitment to making environmentally responsible decisions has expanded the scope, depth, and time required to perform the requisite environmental analysis supporting decisions on Presidential permits and electricity export authorizations.

Finally, growing opposition by the public to new transmission facilities has increased the number of intervenors in these regulatory proceedings with a resulting increase in the administrative workload.

Question: Will processing time on these cases also increase in 1991? If so, what additional personnel and funding would be needed to keep processing time equivalent to 1990?

Answer: Yes. Although the processing time for Presidential permits and electricity export cases will increase in 1991, the requested 7 FTEs should be sufficient.

Question: Please summarize for the Committee the level of activity in imports of both gas and electricity and the extent of its influence on regional or national markets.

Answer: The U.S. imported about 1.38 Tcf of natural gas in 1989, or about 7.3 percent of the total U.S. annual consumption. Canada's share of the U.S import market was about 97 percent, with the other 3 percent coming from Algeria. 1989 was the second year in a row for historic high levels of natural gas imports into the U.S. Most imported gas continues to be purchased by pipelines supplying California, the Pacific Northwest, and the North Central States. However, with the emergence of the natural gas spot market and open-access transportation, sales today are much more widespread than in the past. In 1988, the percentage of total state gas consumption was as follows: 1. Washington (51%); 2. Idaho (49%); 3. Iowa (39%); 4. Minnesota (32%); 5. Oregon (30%); and 6. California (20%).

In 1988 the U.S. imported approximately 31.8 billion kilowatt-hours (KWH) of electric energy. Of this total, 94 percent (30 billion KWH) was supplied by Canada with 6 percent coming from Mexico. This represented approximately $800 million in trade with these two countries. During 1988, imports of electric energy accounted for only 1.15 percent of the total U.S. electrical energy requirements. However, the role of imports becomes more significant on a regional basis. During 1988, the New England States imported approximately 10 percent of all electricity consumed; New York State ranked second in 1988 with 8.7 percent of its electricity requirements being met with imported electricity.

Question: Has the U.S.-Canada trade agreement had any influence on the level of imports?

Answer: The Free-Trade Agreement has had no measureable influence to date on the level of gas imports. Since the mid-1980's, U.S.-Canada energy trade has been largely market based, with minimal government interference from either the U.S. or Canadian regulatory agencies. Therefore, as far as gas trade is concerned, implementation of the Free-Trade Agreement merely ratified what was already in existence. However, the Free-Trade Agreement should have significant influence in providing the gas industry with confidence in negotiating long-term supply arrangements, fostering capital investments, and promoting the exploration, development, and production of additional gas supplies in both countries.

Electricity trade between the U.S. and Canada has been market driven from the beginning of this century. Inasmuch as there were no regulatory impediments to free trade in electricity, the Free-Trade Agreement has had no measurable impact on electricity transactions between the two countries.

Question: Please explain the significance of your approval of the export of North Slope gas through the proposed Trans-Alaska Pipeline.

Answer: Approval of Yukon Pacific Corporation's (Yukon Pacific) project to export liquefied natural gas by means of the Trans-Alaska Gas System (TAGS) could yield an estimated $62.5 billion in trade revenues to the U.S. over the 25-year life of the project and $1 million to $3 million in daily royalty, tax and other revenues to the State of Alaska. In addition, the construction would create 7,200 jobs in Alaska and a permanent workforce of 550. Another 3,400 jobs could be created indirectly and 1,000 permanent support jobs could also be created.

Question: What is the status of appeals to your decision?

Answer: On December 15, 1989, Alaskan Northwest Natural Gas Transportation Company (Alaskan Northwest) and Foothills Pipe Lines (Yukon) Ltd. (Foothills), sponsors of a competing private commercial project, the Alaska Natural Gas Transportation System (ANGTS), filed individual applications for rehearing of the DOE's decision in Opinion and Order 350 (Order 350) authorizing Yukon Pacific's export project. On January 12, 1990, Alaskan Northwest and Foothills each filed with the U.S. Court of Appeals for the District of Columbia a protective complaint under the Alaska Natural Gas Transportation Act (ANGTA) challenging Order 350. On January 25, 1990, the Court granted their joint motion to hold the proceedings in abeyance until the completion of administrative and judicial reviews of Order 350 under the Natural Gas Act (NGA). The DOE issued an order denying their rehearing requests on March 8, 1990. The next step would be for Alaskan Northwest and Foothills to petition the U.S. Court of Appeals for review. They have not done this as of April 3, 1990.

Question: On what basis were the appeals made?

Answer: The principal contentions of Alaskan Northwest and Foothills were that: (1) Order 350 is inconsistent with ANGTA, the 1977 bilateral agreement between the U.S. and Canada relating to the ANGTS, and the measures taken to implement these documents; (2) Order 350 improperly permits Yukon Pacific to compete for North Slope natural gas reserves that "belong" to the ANGTS project; (3) Order 350 represents a taking of property and violation of substantive due process with respect to Alaskan Northwest's and Foothill's "franchise" to bring North Slope gas to the Lower-48 States; (4) the export of North Slope gas is not consistent with the public interest; (5) the DOE did not comply with statutory, regulatory, and procedural due process requirements in issuing Order 350; and (6) Order 350 improperly restricts the regulatory authority of the Federal Energy Regulatory Commission and the Office of Federal Inspector for ANGTS.

Question: What are the steps in the appeal process?

Answer: The DOE's order denying the applications for rehearing filed by Alaskan Northwest and Foothills constitutes final agency action in the proceeding. Under the NGA, they may seek judicial review within 60 days after the order.

Question: What was the basis of your approval?

Answer: The DOE concluded that North Slope gas is not needed to meet U.S. domestic requirements because of both adequate supplies in the Lower-48 States and the availability of alternative secure supplies from Canada and other foreign countries, and that the proposed export will not adversely affect the quantity, quality, or price of energy sources available to American consumers. In addition, the DOE found that the TAGS project will provide important benefits in the areas of energy security, energy production, international relations, trade deficit reductions, and the Alaskan economy. Moreover, the DOE found no evidence that the TAGS construction could not be managed in a way to avoid impairing the construction and operation of ANGTS.

Question: Is there enough gas on the North Slope to supply both the Trans-Alaska Gas System (TAGS) and the Alaska National Gas Transportation System (ANGTS)?

Answer: The gas resources on the North Slope are estimated to be 126 Tcf. The Yukon Pacific project proposes to export up to 16.5 Tcf. According to the ANGTS sponsors, the ANGTS project needs 26 Tcf for construction and initial operation.

Question: Has there been any reaction from Canada?

Answer: The Canadian Government expressed its concern to the DOE and the U.S. Department of State about the impact of Yukon Pacific's export project on the viability of the ANGTS project. The DOE carefully considered Canada's concerns and crafted Order 350 in a manner consistent with the U.S./Canada agreements to remove government impediments to a privately financed ANGTS. In response to Canada's concerns, the State Department has stated, "The United States Government has fulfilled, and continues to fulfill, its commitments to ANGTS . . . [W]e believe it would be inconsistent with market principles if we were to impose regulatory restrictions on private sector projects while advocating a private sector solution for ANGTS."

Question: Are any additional approvals necessary in order to export the gas?

Answer: Yukon Pacific still needs Federal Energy Regulatory Commission approval of the place of export. The State of Alaska must approve the intrastate pipeline and other Federal agencies must grant the required permits for such matters as use of wetlands and navigable waters and pipeline safety.

Question: In that time period are construction decisions on the TAGS pipeline expected?

Answer: According to Yukon Pacific, the TAGS project is expected to be completed and gas flowing by 1996.

Question: Please explain the controversies surrounding the construction of gas pipelines in the Northeast and what the Department's role is in the pipeline cases.

Answer: The Federal Energy Regulatory Commission (FERC) is the Federal agency primarily responsible for certifying the construction of new interstate pipeline facilities in the U.S., under Section 7 of the Natural Gas Act (NGA). The DOE is charged under Section 3 of the NGA with the regulation of imports and exports of natural gas.

On July 24, 1987, the FERC initiated the Northeast "open season" proceeding to consider whether there exists a need for new gas services and facilities in the Northeast. Of particular concern to the FERC was being able to establish a specific period for the filing and consideration of mutually exclusive or competing proposals which would require lengthy comparative proceedings. The "open season" proceeding resulted in a general settlement by the applicants in which it was agreed that the proposals were not mutually exclusive.

The "open season" proceeding resulted in two new proposed major pipelines to bring Canadian gas into the Northeast, Iroquois/Tennessee and Champlain, as well as numerous other proposals for pipeline expansion and construction. Due to supply problems, FERC action on Champlain's application has been suspended at Champlain's request.

The National Environmental Policy Act of 1969 (NEPA) requires the FERC to give appropriate consideration to the environmental effect of its proposed actions. Regarding Iroquois/Tennessee, the FERC issued a Draft Environmental Impact Statement (EIS) on November 28, 1989, in which it addressed various site specific concerns but preliminarily concluded that if recommended mitigating measures to reduce the anticipated environmental impacts are adopted, construction and operation of the proposed facilities would be an environmentally acceptable action. The DOE is a cooperating agency with the FERC and will assist the FERC in its preparation of a Final EIS.

The natural gas supplies that will be delivered over the Iroquois system are the subject of numerous applications being considered by the Department. The Department cannot issue a final authorization in any of these proceedings until the FERC has issued a Final EIS and the Department has reviewed and accepted the EIS.

Federal Inspector for the Alaska Gas Pipeline

Question: What effect does the approval of the export of gas through the proposed TAGS pipeline system by DOE have on the ANGTS system and the Federal Inspector?

Answer: DOE's export approval of the proposed TAGS pipeline system included a condition that prohibits any action in connection with the export projects that would compel a change in the basic nature and general route of the ANGTS, or otherwise prevent or impair in any significant respect the expeditious construction and initial operation of ANGTS. DOE further indicated that the Federal Inspector would be responsible for enforcing this condition.

DOE's action, in effect, reaffirms the Federal Inspector's responsibilities under Reorganization Plan No. 1 of 1979, to enforce all Federal statutes and authorizations which related to the ANGTS in any manner whatsoever to the extent necessary to preserve its integrity. Because of the proximity of the two systems, the Federal Inspector will closely monitor the activities concerning the proposed TAGS pipeline to evaluate the effects on ANGTS, if any, and take appropriate action, if any, to discharge the Federal Inspector's responsibilities.

Question: You have reactivated the Executive Policy Board because of increased activity. What has been the nature of the increased activity?

Answer: The Alaskan and Canadian leg sponsors have announced a significantly reduced cost estimate for ANGTS and indicated that they may resume activities to complete the entire System in the foreseeable future. In light of these indication, the Executive Policy Board was reactivated as a prudent and reasonable measure to familiarize the Members of the Board with the ANGTS and the potential issues its completion involves so that they could be prepared to act when the need arises.

In addition, there has been much activity concerning increased flows of Canadian/Arctic gas to the Lower 48 States. Since this gas flows through the prebuild or southern sections of ANGTS, or may flow through pipelines competing with ANGTS, these activities have a direct relationship to the ANGTS and its financing. In particular, as a result of the increased flow of Canadian gas through the Eastern and Western legs of ANGTS, there are proposals to expand and extend these prebuild sections in both the U. S. and Canada.

Also, the sponsors of the Trans-Alaska (oil) Pipeline System (TAPS) have announced a comprehensive repair program for the oil pipelines. Since the TAPS parallels the ANGTS right-of-way, it may be necessary for the Federal Inspector and the Executive Policy Board to have a role in interagency activities concerning this repair, which potentially could affect the construction and operation of the ANGTS.

Question: What are the current estimates of when construction might take place on the Alaskan segments of the pipeline?

Answer: The Alaskan project sponsors have indicated to the Federal Inspector's Office that they remain committed to the completion of ANGTS as soon as market conditions permit. They believe the gas will be needed in the Lower 48 States by the late 1990's, but as yet have not indicated a date for resumption of work to complete the System. Once construction begins it would take approximately five to seven years to complete the project and begin operation.

QUESTIONS SUBMITTED BY CONGRESSMAN RALPH REGULA

Acid Rain

Question: I have serious concerns about the impact of proposed acid rain legislation on the Clean Coal program. I am concerned that the compliance deadlines in all of the pending proposals would preclude the use of new clean coal technologies. Would you comment on this?

Answer: Admittedly, the deadlines are tight but we believe they are workable in terms of having Clean Coal Technologies play a role in meeting Clean Air Act Legislation targets.

The request by industry for more time must be balanced against environmental concerns and the impacts associated with delay. The Administration's proposed Clean Air Legislation is an attempt to balance these energy and environmental considerations. Also, the Clean Coal Technology Program is not only intended to impact on the immediate targets represented by phases 1 and 2, it must develop the technologies that will satisfy both future economic growth (and related energy demand), and emission levels consistent with the cap established by the Clean Air Act Legislation.

Question: Is it accurate to say that the Clean Coal program is already supporting a large number of projects located in those states where affected sources will be found?

Answer: Yes. Of the 38 projects selected, 28 are located in those States with affected sources.

Question: Do you fear that the Sharp amendment could unduly focus the program toward retrofit only technologies at the expense of repowering technologies?

Answer: Any legislative action that would target subsidization of compliance by affected sources would be underwriting installation of retrofit technologies. Clearly, retrofit technologies will be commercially available long before repowering technologies.

A subsidy to affected sources would be short sighted and ineffective. Repowering technologies are essential to meeting future energy needs in the face of low emission allowances. The $1.2 billion in available Clean Coal Technology funding represents only a token amount relative to the cost of retrofitting affected sources. However, applied to selected demonstrations, the $1.2 billion could provide an essential step toward commercialization of advanced, more efficient, economic technologies to meet proposed Clean Air Act Legislation targets.

Question: Given the constraints that the acid rain bill will impose on the clean coal program wouldn't it be wise to keep the program open to the widest range of participants in an effort to insure that the widest range of technologies are demonstrated?

Answer: The Clean Coal Technology Program has, and will continue to support a diversity of technologies in recognition of industry's need for a range of options to fit a range of situations. Consistent with this approach, there is no known discrimination against any category of potential Participant. This is supported by the broad spectrum of Participants (and technologies) involved in the CCT Program.

Question: Recently DOE did an analysis for me concerning technological approaches to reducing acid rain emissions which concluded that most of the 493 affected coal power plants would opt for fuel switching in the short term. The analysis went on to say that regardless of the options selected, some electricity intensive industrial consumers may find that the price of electricity renders their activities uncompetitive. This would seem to me to be a serious concern and one which should concern this Administration. What is your reaction?

Answer: The acid rain provisions of S. 1490 and S. 1630 will likely have a small effect on the international competitiveness of electricity-intense industries. Nationwide, EPA/ICF has projected that S. 1490 will increase utility rates by an average of approximately 2.0%. Projected rate impacts in specific regions varied, however.

Electricity-intense manufacturing (e.g., primary aluminum, petroleum refining, chemicals, and paper products) are typically located in regions in which rate impacts are projected to be small. Rates in Washington and Oregon, a region replete with many energy intensive industries such as aluminum smelting and paper manufacturing, are projected to rise less than 1.0% by 2005.

Rates in neighboring Idaho are projected to remain unaffected. Rate increases in Texas and Louisiana, states with an abundance of petrochemical plants, are projected to rise approximately 1.0%. Rates in Michigan, a state with much heavy manufacturing, are also projected to increase by less than 1.0%.

Although average rates in many Midwest industrial states are projected to increase 2.0% to 5.5% by 2005, average rate increases are not necessarily indicative of rate increases for specific customer classes. Rate increases for electricity-intense industrial customers may be much lower than the average.

U.S. industrial electricity prices in 1985 were as low as $0.2./kwh for primary aluminum manufacturers, $0.025/kwh for industrial inorganic chemicals, and $0.033/kwh for paper mills in the West Census Region. (EIA, *Manufacturing Energy Consumption Survey: Changes in Energy Efficiency 1980-1985*, DOE/EIA-0516(85).) Average industrial rates per kilowatthour were $0.048 in the U.S. in 1988, compared with $0.089 in West Germany and $0.146 in Japan. (EIA, *Manufacturing Energy Consumption Survey: Consumption of Energy, 1985*, DOE/EIA-0512(85).)

Moreover, in the past decade, many U.S. firms have refined their production processes and improved their energy efficiency. Between 1980 and 1985, energy intensive manufacturing industry groups improved efficiency by 17% (as measured by British thermal units per constant (1980) dollar value of shipments). (EIA, *Manufacturing Energy Consumption Survey: Changes in Energy Efficiency 1980-1985*, DOE/EIA-0516(85).)

The air toxins provisions of S. 1630 will affect substantially more utility power plants and result in significantly higher compliance costs than S. 1490. S. 1630 will result, therefore, in higher utility rates in nearly all regions and may affect some industries adversely.

Clean Coal

Question: According to industry a new technology is not considered to be successfully demonstrated until it has undergone multiple commercial demonstrations addressing a range of boiler designs, fuel types, and other operating variables to provide potential users with information and experience upon which to judge costs, efficiency, and reliability when compared to conventional alternatives for reducing emissions. Using that definition when is the earliest clean coal technologies would be available and what technologies are likely to meet that criteria the soonest?

Answer: The number of "multiple commercial demonstrations" needed to judge costs, efficiency and reliability is a function of the sophistication and/or complexity of the technology as well as its inherent sensitivity to scaling, feedstock and operating variables. With that in mind, recognizing relevant parallel industry efforts in the various technology areas, and anticipating response to upcoming solicitations, the following are DOE's projections for commercial availability:

o Advanced Physical Cleaning	1993 - 1998
o Chemical/Biological Cleaning	1996 - 2000
o Atmospheric Fluidized Bed	1996 - 2001

Pressurized Fluidized Bed	1998 - 2003
Advanced Combustors	1993 - 1997
Gas Reburning	1993 - 1996
Post Combustion Duct Injection	1991 - 1995
Advanced Scrubbers	1995 - 1999
Integrated Gasification Combined Cycle	1998 - 2003

Question: Given that definition would you favor multiple demonstrations of the technologies that seemed most promising and can you indicate which technologies might be considered for multiple demonstrations?

Answer: The Clean Coal Technology Program has striven to provide a diversity of technology options to meet a diverse set of industry requirements. In doing so, environmental and cost performance have been underscored. Furthermore, a balance has been struck between those technologies that could have relatively near term impact and those that can meet future energy needs in the face of stringent emission limits.

Using that definition, the Clean Coal Technology Program is supporting multiple demonstrations of the technologies considered most promising of those offered by the industrial participants. It should be noted that the CCT Program has proceeded on the premise that industry, as a full financial partner, would select the technologies for development. It has been assumed that the financial commitment would insure that the technologies proposed and selected would be the ones industry considered as most promising with the greatest potential to accomplish the objectives of that utility, industry, or vendor.

The record would indicate that this course of action has resulted in multiple demonstrations of what our evaluations indicate to be the most promising technologies in the retrofit, repowering and industrial applications areas.

These projects are addressing a range of boiler designs, fuel types, and operating variables to provide potential users (as determined by industry) with the information needed to make commercial decisions.

Question: Do you agree with industry estimates that it may take 5 to 10 years for the technologies to penetrate the market once they are demonstrated and available for commercial order?

Answer: Our estimate of the time requires to achieve widespread use, i.e., that period during which the first commercial plants are introduced, is three to six years. The three years is associated with some of the less sophisticated technologies such as gas reburn and sorbent injection. The six years is required for the more complex technologies that involve a larger part of the facility. It should be noted, however, that a six year period for market penetration does assume a regulatory environment that will drive industry to use clean coal technologies.

Question: Even if the time frames do preclude the use of clean coal technologies to comply with likely utility sulfur dioxide emission reduction requirements, would these technologies be useful given the emissions cap and the need for cleaner technologies to accommodate future growth?

Answer: Yes, an important element of the Clean Coal Technology Program is, indeed, the requirement to develop technologies that will satisfy both the energy needs of a growing economy and the emissions cap associated with pending Clean Air Legislation.

Question: Would they not also be useful in terms of an export commodity and aid our ability to address the environmental problem on a global basis, particularly in areas such as Eastern Europe which have historically ignored environmental issues?

Answer: Clean coal technologies have the potential to become a significant export commodity which can also address the environmental problem on a global basis. These issues are the objective of our Coal Technology Export Program.

Question: GAO reported last March and in follow up investigations that DOE had experienced major delays in negotiating cooperative agreements in both round 1 and 2 project sponsors. They have also indicated that delays are being experienced in getting projects underway once agreements were finalized. Do you see this as a continuing problem and what is being done to address these problems?

Answer: The Program has experienced some problems in moving forward in a timely fashion. However, it now has momentum with 16 projects under award and another 22 scheduled to complete negotiations by the end of the calendar year (13 of which were selected under Round #3 in December 1989). Round #1 was a learning experience resulting in a number of withdrawals and terminations. Criteria were modified for Round #2 in the area of corporate commitment and capability to finance. Consequently, we do not anticipate in later rounds the kinds of problems experienced in Round #1. In addition, to accelerate the process, the Secretary of Energy introduced a new procedure in November 1989 designed to speed the pace, and set mandatory schedules for completion.

Question: In a report released this month by GAO they reported that many of the projects chosen in round 2 are to demonstrate technologies whose potential to reduce nationwide emissions when used at existing coal-burning facilities was rated "weak" by DOE's evaluation board. What is your response to this?

Answer: DOE's Source Evaluation Board used the terms "weak" and "strong" only as a qualitative measure of the projects' ability to meet specific criteria listed in the PON. However, the projects were selected on the basis of their overall rating for all the criteria given.

Moreover, the emission reductions criteria were but two of the 10 criteria used in the selections. Among other characteristics, the 10 criteria represent a careful balance between "potential" and "actual" emissions. For example, sometimes immature technologies can project very optimistic expectations while more mature technologies might project more realistic expectations. Taken as a whole the selection process has a self-correcting mechanism that balances high expectations with hard nosed engineering and business sense.

It appears that GAO may have considered only one or two criteria out of many carefully selected criteria designed to identify the strongest projects from a technical, business and management, commercialization and emissions reduction potential standpoint.

Question: While GAO also concluded that the projects selected in round 2 were the best projects submitted for the mix of technologies that DOE was interested in seeing demonstrated, some of the projects may have difficulties in successfully demonstrating and ultimately commercializing their technologies. What is your response?

Answer: A demonstration program is a development program and accordingly it should not be expected that all projects will be successful. However, the CCT Program is intended to risk share with industry in order to accelerate the movement of innovative technologies into the market place. In evaluating proposals, DOE seeks to strike a balance between degree of risk and potential payoff, but in no case selects a project that has not established that it is ready for demonstration.

It should be noted, however, that in the case of all projects, the industrial partner believes the risk involved in demonstrating and commercializing the technology is low enough for him or his partners to assume more than 50% of the costs: a multi-million dollar decision in almost every project.

Question: Do you believe, as GAO suggests, that this may indicate DOE could have problems in identifying and funding additional promising clean coal technology projects in future rounds?

Answer: GAO's assessment was based on a review of Round 2 projects, yet, DOE received 48 proposals in Round 3 and had no difficulty selecting 13 projects that could make significant contributions to the Program's goals. The Program expects that Round 4 will attract proposals that also will make significant contributions.

Question: GAO also suggested delaying round 4 and 5 solicitations until DOE obtains results from some of the early round demonstrations and could then focus the remaining funds on the more promising technologies. I have some concerns about round 4 and 5, but I was interested in your reaction.

Answer: DOE is sympathetic to GAO's concern that Federal money be spent effectively and efficiently. DOE believes, however, that delaying the Program would not be wise. Further delay could cause the Program to miss affecting investment decisions relative to meeting the Phase II targets in the pending Clean Air Amendments. There was a strong signal to this effect coming out of the public meetings on the Round 4 solicitation.

It should be noted that GAO focused only on the selection process, overlooking the Program's operational procedures that ensure Federal money is spent wisely. Finally, this suggestion appears to contradict another GAO recommendation made in testimony (10/18/90) that the current pace of development was too slow to have a major effect on emissions.

Question: For the record could you provide a status report of all projects selected to date.

Answer: CCT-I PROJECT STATUS

- Projects Proceeding Under Cooperative Agreements

  American Electric Power Service Corp. (AEP) - PFBC (TIDD) This Project is to demonstrate pressurized fluid bed combustion at the 70MW scale. It is essentially on schedule with shakedown to begin in September and operation in December 1990/January 1991.

  The Babcock & Wilcox Company (B&W) - LIMB - This project is to demonstrate two sorbent injection techniques for SO2 reduction in conjunction with a low NOx burner. The

"Coolside" duct injection concept completed testing with very promising results -- 70 percent SO2 reduction realized, verifying pilot scale test projections.

Coal Tech Corp. - ASC - This advanced slagging combustor project will be completed in June 1990. Most basic operating performance targets were achieved. Excellent NOx reduction characteristics were demonstrated. SO2 capture atmospheric performance is under evaluation.

Colorado-Ute Electric Association (CUEA) - CAFB - This circulating fluid bed combustion project is approximately 1 1/2-years into a 2-year test program in a utility operations mode. There has been no problem in meeting NSPS (.6LB SO2/MM Btu and 70 percent SO2 reduction). NOx emissions are quite low because of low bed temperatures used.

Energy and Environmental Research Corp. (EER) - GR/SI Construction was initiated on this project involving the demonstration of gas reburn/sorbent injection for NOx/SO2 control on 2 boiler types (cyclone and tangentially-fired units).

TRW, Inc. - ASC - This advanced slagging combustor project is in the design phase with construction scheduled for January 1991.

Ohio Ontario Clean Fuels, Inc. (OCF) - Coal/Oil COP Preliminary engineering and PDU testing was completed on this coal/oil coprocessing project with promising results. However, the Participant is experiencing difficulty in securing financing for the balance of the project (decision point in June 1990).

o Projects In Negotiation

Combustion Engineering, Inc. CE-CO, Inc. - This project is to demonstrate combustion characteristics of physically beneficiated coals in utility applications. Negotiations should be completed in April 1990.

Western Energy Co. (WECO) - This project is to demonstrate a process for upgrading high moisture, high ash, subbituminous western coals. Negotiations should be completed in June 1990.

City of Tallahassee (CoT) - This project is to demonstrate circulating atmospheric fluid bed combustion at the 250MW scale. Negotiations should be completed in August 1990.

CCT-II PROJECT STATUS

- Projects Proceeding Under Cooperative Agreements

Bethlehem Steel Corp. - This coke oven gas clean-up project is in the construction phase and on schedule.

Passamaquoddy Tribe CEMENT KILN - Design is nearly complete on this cement kiln recovery scrubber designed to remove SO2 and recycle all solids. Some site preparation work has been completed. Further construction is awaiting a break in the weather - April 1990.

Southern Company Services, Inc. (SCS) - LNB (WALL-FIRED) This project is to demonstrate an advanced low NOx burner with over fire air in a wall-fired boiler. Baseline testing was completed and installation of the low NOx burners (LNB's) initiated. Design work is being conducted in parallel on integration of LNB's and advanced over fire air systems.

Pure Air - AFGD - This project is to demonstrate an advanced flue gas desulfurization technology at the 600MW scale. Successfully completed a series of small scale tests in support of design baseline. Ground breaking is planned for April 1990.

Combustion Engineering, Inc. (CE) - WSA-SNOX - This advanced flue gas clean-up system (SO2/NOx) is in the design stage with small scale tests to support design baseline scheduled for May 1990.

The Babcock & Wilcox Company (B&W) SOx-NOx-ROx Box This advanced flue gas cleanup project for combined SO2/NOx control is in design and on schedule to go into construction in approximately a year. Test work is in process on conforming catalyst to high temperature bags.

American Electric Service Corp. (AEP) - PFBC (SPORN) This project, which will demonstrate pressurized fluid bed combustion at the 330MW scale, was just awarded April 4, 1990.

Southern Company Services, Inc. (SCS) - CHIYODA - This project, which will demonstrate an advanced flue gas desulfurization technology at utility scale, was just awarded April 2, 1990.

The Babcock & Wilcox Company (B&W) - REBURN - This project, which will demonstrate a coal reburn, low NOx burner technology, was just awarded April 2, 1990.

- Projects In Negotiation

  TRANSALTA Resources Investment Corp. - ASC - This project is to demonstrate an advanced slagging combustor for cyclone boiler retrofit (NOx control). Negotiations should be completed in April 1990.

  Southern Company Services, Inc. (SCS) - SRC - This project is to demonstrate selective catalytic reduction for flue gas NOx reduction. Negotiations should be completed in April 1990.

  Combustion Engineering, Inc. (CE) - IGCC - This project is to demonstrate integrated gasification combined cycle technology for repowering. Negotiations should be completed in May 1990.

  Southern Company Services, Inc. (SCS) - LNB (T-FIRED) This project is to demonstrate an advanced low NOx burner with over fire air in a tangentially-fired boiler. Negotiations should be completed in June 1990.

  OTISCA Industries, Ltd. - This project is to demonstrate a coal/water slurry for industrial applications. Negotiations should be completed in October 1990.

  Southwestern Public Service Co. - The Participant is re-examining whether he wished to pursue the project in light of being informed that he will have to do an Environmental Impact Statement.

CCT-III PROJECT STATUS

- The following 13 projects were selected December 19, 1989. Preaward Milestone Schedules have been negotiated with all Participants to complete negotiations by December 19, 1990.

  Airpol, Inc. - SO2 reduction, Gas Suspension absorption

  LIFAC - North America - SO2 reduction, sorbent injection (boiler)

  The Babcock & Wilcox Company - NOx reduction, low NOx cell burner

  Energy and Environmental Research Corp. - NOx reduction, gas reburn/low NOx burner

  Bechtel Corporation - SOx/NOx reduction, confined zone dispersion

M.K. Ferguson Co. - SOx/NOx reduction, NOXSO Process

Public Service Company of Colorado - SOx/NOx reduction, low NOx burner/sorbent injection (duct)

Alaska Industrial Development and Export Authority - Advanced Slagging Combustor incorporated in cogeneration plant

Air Products & Chemicals - Liquid phase methanol production

ENCOAL Corp. - Mild gasification to produce liquid and solid fuel

Bethlehem Steel Corp. - IGCC with hot gas clean-up

Dairyland Power Cooperative - Circulating PFBC

Question: Assuming we do go forward with rounds 4 and 5 there has been some discussion of possible changes in the fourth Clean Coal solicitation with respect to foreign participation and repayment provisions. I would preface my remarks by saying that I hope you can assure us that there would be no changes without review and participation by industry and Congress. What is the existing policy with respect to foreign participation in DOE funded fossil projects and what has that policy been with respect to Clean Coal? Are you currently contemplating any changes for Clean Coal 4?

Answer: The solicitation development process assures that the Program Opportunity Notice (PON) ultimately released will have input from all concerned parties. Public meetings have been held and a draft PON will be issued for comment by all parties.

There has been no restriction on foreign participation in Rounds 1,2 and 3. However, the projects must be sited in the U.S. and must be designed to use U.S. - mined coal. A recent Department decision on this subject would ensure that the funding applied to the program has the best possible chance of best serving public interests in terms of meeting environmental objectives and maintaining a strong U.S. economy.

Some changes have been contemplated for Round 4. Any change, however, will be incorporated into the draft PON issued for comment.

Question: Last year we discussed deployment of clean coal technologies and in response to a question I asked DOE indicated that during FY 89 they would begin implementing a technology transfer/outreach program to distribute the data required for the private sector to make decisions about the commercialization of the technologies. Could you describe that program and do you propose to continue it in your FY 91 budget?

Answer: The outreach effort under the Clean Coal Technology Program is an aggressive technology transfer undertaking designed largely to inform potential domestic and foreign users, State and local governments, as well as the public. In regard to the State and local governments and the public, it is hoped that incentives rather than disincentives to coal use will result.

Specific thrusts in the outreach effort will include Topical Reports on progress at critical points in the projects, workshops to bring Participants together with potential users, exhibits and presentations at key events.

The outreach effort will continue as an integral part of the Clean Coal Technology Program in meeting commercialization objectives.

Question: The Innovative Control Technology Advisory Panel (ICTAP) last year published a report on commercialization incentives. To the extent that DOE and the Administration can have an impact, what is the status of implementing those incentives?

Answer: The ICTAP Report has had a positive effect in many areas. First, the report recommended the continuation of the CCT Program. The Report also recommended that the Program continue to diversify its choices among a wide range of technologies.

Regarding regulatory reform, the ICTAP Report recommended that State regulators consider the use of reforms such as "rolling prudency reviews." which could reduce the risk of regulated clean coal technology investments to potential users. Some States, such as Indiana, have now taken this step.

The report also recommended that Federal regulators develop incentives to reduce regulatory uncertainties for CCT demonstrations. The Administration/Senate Clean Air compromise bill, now pending, contains such incentives.

Finally, the Report recommended that CCT demonstrations not be inhibited by the PSD interpretation in the "WEPCO" decision. Although the Senate/Administration compromise bill provides some improvement in this regard, relative to existing law, it does not remove all PSD-related disincentives to CCT projects.

With respect to legislation in the House, the electric rate incentives contained in section 415 of the Senate/Administration Compromise CA bill are not present in the bill reported out of

Committees in the House. Additionally the House provisions addressing new source reviews for permanent CCT demonstration projects do not remove the disincentives to CCT projects which are in existing law.

Calderon Project

Question: What is the status of the Calderon project? When will construction be complete and is it on schedule?

Answer: The Calderon project involves the design, construction, and operation of the Calderon gasification/hot gas cleanup process at 24 tons per day PDU scale. The project construction phase is several months behind schedule, but is now nearing completion with all process vessels now in place and piping and instrumentation scheduled to be completed by late April 1990. The construction phase includes system start-up and shakedown, which is schedules for completion by May 31, 1990. The operational phase is scheduled to start on June 1, 1990.

Question: What is the status of the current audit?

Answer: The Defence Contracts Audit Agency (DCAA) has recently performed an audit of the Calderon program at the request of the Morgantown Energy technology Center (METC). The audit document was delivered to METC on March 1, 1990. Findings indicate a 14.6 percent participant cost share as of January 1990, as compared to an overall goal of 20 percent cost share for the project. However, the Ohio Coal Development Office (OCDO) has recently released an additional funding grant of $1.5 million for completion of the project, which will bring the overall participant cost share up to the Congressionally stipulated 20 percent level. Other results of the audit are undergoing further review within DOE; results of this review are expected within the next three months.

Oil Shale

Question: Could you provide for the record the latest figures on total funding for eastern vs. western oil shales? Please include FY 88 and FY 89 as well as your budget request for FY 90 and a figure detailing what has been spent in total over the life of the program for both eastern and western shale research.

Answer: Funding for the last three years and the budget request for FY 91 is shown below:

	(in thousands if dollars) Eastern	Western
FY 88	4756	4748
FY 89	6135	4395
FY 90	3730*	5284
FY 91 Request	315	347*

* Estimated

Over the history of DOE's oil shale research program prior to FY 1988, an estimated $39 million has been spent on eastern oil shale research and approximately $181 million on western.

Question: What was your request to OMB for oil shale and of that amount how much, if any, was specifically for eastern shale?

Answer: The DOE request to OMB in FY 1991 was $1,000,000 to maintain a core program at METC and the Western Research Institute under the Cooperative Research Agreement. No funds were requested for specific eastern oil shale research, but based on past distribution of research on eastern and western oil shale, about 45% to 50% would be spent on eastern oil shale.

Question: If money were added specifically for eastern shale research, what would you recommend doing?

Answer: DOE does not believe that additional funds are warranted for oil shale research in a time of budgetary constraints and in view of current and projected oil prices, which are a reflection of plentiful supplies of petroleum worldwide. However, if funds were added specifically for eastern oil shale research, continuation of presently ongoing research activities and contracts would have priority over any new activities. Some examples of presently ongoing eastern oil shale research include continuing applied characterization studies of eastern oil shale samples (WRI) and conducting research recommended by IGT on pressurized fluidized bed retorting using hydrogen as the gas media for eastern oil shale conversion.

Babcock and Wilcox Fluid Bed Fuels Characterization Program

Question: Babcock and Wilcox has proposed a $6 million, three to four year research project to characterize the fundamental combustion behavior of all coals under fluid bed combustion conditions. The proposed fundamental research project utilizes unique state-of-the-art bench-scale test reactors to obtain fundamental combustion data which can improve the application of fluid bed combustion technology to all coals. Are you familiar with the B&W proposal and if so what is your opinion of the proposal.

Answer: DOE is familiar with the proposal and the ongoing work that B&W has been doing for the Electric Power Research Institute in a program called "Characterizing Fuels for Utility-Scale Atmospheric Fluidized-Bed Combustors." DOE's opinion of this proposal is that a characterization of all the highly mined coals in the U.S., i.e., the proposed database, is not very useful. It would be more useful for current and future fluidized bed combustor users to have reliable and consistent test methods available to them just as there are American Society of Testing Materials (ASTM) test methods for pulverized coal boilers available in thousands of private coal testing laboratories across the country. This may require some additional work to make the bench scale methods that B&W has developed into truly predictive tests.

The proposal states that "B&W believes that this work will enhance its competitiveness and bring these important technologies to the market place faster." DOE does not agree that this work would enhance B&W's competitiveness. Nor does DOE agree that this work would bring the technology to the market place faster, since atmospheric circulating fluidized bed combustion already is one of the fastest growing energy technologies, accounting for approximately 25% of new boiler sales.

Question: Would it be useful to expand the database and the fundamental understanding of combustion characteristics of all coals which are highly mined?

Answer: From a purely scientific viewpoint, assuming unlimited resources, it would be useful to expand the fluidized bed combustion characteristics database to all highly mined coals. DOE agrees that fundamental pulverized combustion tests cannot be used to predict fluidized bed coal combustion. Instead, specific tests that duplicate the conditions in a fluidized bed are required.

However, DOE questions the advisability of attempting to produce a database that can accommodate all of the different fluidized bed designs that exist, particularly atmospheric circulating units and pressurized units. DOE believes that trying to make a database that address all of the issues related to different designs for all highly mined coals would undoubtedly be a much larger and more expensive project than B&W has proposed.

Question: Would there be a benefit to an approach which employs inexpensive bench-scale tests to characterize the fuels vs expensive pilot-scale testing of each fuel?

Answer: Generally there is a benefit to inexpensive bench-scale tests versus pilot-scale tests. Tennessee Valley Authority has recently used two of these bench-scale tests at B&W to resolve an operating problem at their 160 MW atmospheric fluidized bed combustor. Besides using the bench-scale tests to resolve operating problems, one can visualize fluidized bed owners using these tests to screen a large number of potential coal sources. However, since no one would make a decision to switch their operating unit to a new coal on the basis of a bench-scale test, the real benefit of these bench scale tests would be to narrow the number of coals. The coals could be narrowed down to one or two which are then tested in a pilot unit. Thus, the database proposed by B&W could be useful, but would never fully replace pilot-scale testing, and in many cases users may want to run special bench scale tests as well. That is why DOE believes that good bench testing standards are more useful than an attempt at a universal database.

Question: Is is accurate that each coal for a Fluid Bed application needs to be evaluated because it has unique properties and if so, wouldn't this be useful given the importance of Fluid Bed technologies in the Clean Coal (Program)?

Answer: Each coal does behave somewhat differently, but not so much as to significantly affect the design of an FBC system. Many coals have been tested in bench- and pilot-scale systems, so designers generally can account for the performance of coal of a particular type. When a utility or industrial firm decides to build a fluidized-bed unit, sources of coal have been identified. If the participating designer/manufacturer of the combustor feels there are insufficient test results regarding a coal's performance, the coal will be tested in a designer-owned facility to generate the missing design information.

Oil and Gas Research

Question: Do you think the supply problems such as those experienced in December would indicate a need to expedite rather than delay thoroughly assessing and characterizing the natural gas reservoirs of the northeastern and midwestern states?

Answer: No, it is not necessary at this time to expedite assessment and characterization work in these areas. The Department has spent much effort and resources over the years in assessment and characterization of eastern gas shales. Presently, we are supporting economic studies involving the tight sandstone resource in the northeastern region. In addition, our planned multi-strata effort will involve the gathering and analysis of data concerning coal, shale and sandstone resources of the Appalachian basin. This effort will delineate areas in the basin where multi-zone completions may be economically feasible.

Question: According to DOE's draft research plan for natural gas, Ohio's tight sand gas resources may not be evaluated within the next five years. Why not and should they be?

Answer: DOE is presently conducting economic/reserve studies of tight gas sand resources in the Appalachian basin. Ohio's resources are included. A planned multi-strata study, which will outline areas where multi-zone completions may be economically feasible, will include Ohio's tight resources. Additionally, a planned atlas series to be developed under our conventional gas initiative, will most likely include the Clinton reservoirs of Ohio. These atlases will include geologic and engineering data that should prove to be helpful to independents.

Question: For the record, could you indicate your analyses of the needs in this area and what additional resources would be required to address the geoscience research needs of Ohio and surrounding states?

Answer: A major need for the area is the acquisition and compilation of geologic, reservoir, and production data on the most important reservoirs in the region into an easily accessible information repository. The repository would most likely take the form of an atlas or series of atlases. The atlases would serve as a knowledge base for the smaller independents. The northeastern region would be a candidate for such an effort. Development of a series of gas atlases is planned as part of the recently completed natural gas implementation plan. No additional resources are deemed to be necessary at this time.

Technical and Economic Analysis

Question: I notice that your Division of Technical and Economic Analyses has done work on oil spill R&D needs, could you comment on those needs and what is going on both domestically and internationally in this area?

Answer: The Fossil Energy Office of Planning and Environment (OPE), whose activities are partially funded through the Technical and Economic Analysis line item, is coordinating DOE activities related to oil spill R&D and working with the U.S. Coast Guard and other agencies to coordinate these activities throughout the public and private sector. As part of the DOE coordination role, a request will be made to DOE labs, operations offices and technology centers for oil spill R&D projects suggestions. Projects with the greatest potential will be forwarded to the Coast Guard for consideration in their interagency program. A summary of oil spill-related activities, complied by OPE, is attached.

March 9, 1990

ACTIONS IN RESPONSE TO EXXON VALDEZ OIL SPILL

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* *Indicates changed from previous report.*

For Further Information or Update
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ACTIONS IN RESPONSE TO EXXON VALDEZ OIL SPILL

Contact/
Phone #

1 - National Response Team (NRT) - Chaired by EPA
Vice-chaired by USCG
Participation by 14 agencies

George
Turner/CG
202-267-4280

- 30-day Incident Report

  - Initial 30-day report (March 24 - April 26) requested by the President to address preparedness for, response to, and early lessons learned from the Exxon Valdez oil spill. Preliminary effects of the spill are discussed. Preliminary recommendations for follow-up are identified. The final report was sent to President Bush on May 18, 1989.

- Contingency Plan Review

  - The President has requested that a nationwide review of port and harbor-contingency plans be conducted. The NRT will conduct this review with the Coast Guard serving as the lead agency. There are 48 plans which will be examined to determine their adequacy in light of the lessons learned from the spill and the critical importance of an adequate and timely response. Results are anticipated by early 1990.

2 - Natural Resource Trustee Council

Cecil
Hoffman/DOI
202-343-3811

- Purpose

  - Coordination of activities in the assessment of damages for injuries to natural resources resulting from the Alaska oil spill. The oil spill's biological impact on fish, birds, aquatic plants, water quality, marine mammals and other wildlife will be assessed. Ultimately, the study will help identify steps necessary to restore wildlife habitats and to encourage the recovery of natural resources in the affected areas.

- Participants:

  -Federal Trustees
    - Department on the Interior
    - Department of Agriculture/Forest Service
    - Department of Commerce/NOAA
  - State of Alaska
  - Exxon

Martin Suuberg
Assoc. Solicitor
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202-343-4344

ACTIONS IN RESPONSE TO EXXON VALDEZ OIL SPILL

Contact/
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- Federal Consultants
  - Environmental Protection Agency
  - Office of Management and Budget
  - Department of Transportation (Coast Guard Federal On-Scene Coordinator)
  - Department of Justice

- The Trustee Agreement calls for establishment of teams for budget control, legal, and management to assist the Trustee Council. These teams are drawn from various agencies and are based in Alaska.

Walter Steglitz
Fish & Wildlife
Service
(DOI)/Alaska

- Exxon Shipping Company provided $15 million for the initial damage assessment. The government has requested an additional $20.4 million for studies. Exxon wants more time to consider the request, claiming that the resource trustees have yet to account for how they spent the earlier $15 million.

- The trustees issued a draft natural resource damage assessment plan in August 1989, and public comments are currently under review. Exxon and thirteen major environmental groups have voiced their disapproval of the plan. They oppose the plan because they say it is too vague, poorly designed, fails to adequately address restoration of the environment, and it downplays the damage caused to the total ecosystem -- focusing instead on resources with a more tangible economic value, such as damages to fisheries.

- Plans for spring clean-up and assessment activities for all agencies will be announced before opening of the summer field season.

3 - National Ocean Pollution Policy Board (NOPPB)

Bud Ehler/DOC
202-377-3563

Bill
Conner/NOAA
202-673-5243

- The NOPPB was established under the National Ocean Pollution Planning Act to promote coordination of marine pollution research, development, and monitoring among Federal departments and agencies. The NOPPB convened an interagency working group which prepared an "Extended Studies Program Plan" (May 1989) for the study of the spill in Prince William Sound. The proposed program focused on environmental and socio-cultural issues that would not be adequately covered under the Damage Assessment Program developed by Federal trustee agencies and the State of Alaska. Since publication of the Draft Damage Assessment Plan, the NOPPB has concluded that the damage assessment effort (as defined for the first year of effort) substantially meets the objectives of the Extended Studies Program. The

ACTIONS IN RESPONSE TO EXXON VALDEZ OIL SPILL

Contact/
Phone #

NOPPB will be tracking the Damage Assessment Program with the intent of identifying opportunities for continuing high priority studies (based on scientific criteria) which would be terminated after satisfying requirements for damage assessment information.

4 - Department of the Interior (DOI)

Hank
Bartholomew
202-343-1398

- National Response Team Support
- National Resource Damage Assessment Trustee Council
- National Ocean Pollution Policy Board (NOPPB) Participation
- Increased Frequency of Safety Inspections
    - Effective April 17, 1989, MMS increased the frequency of their surprise safety inspections in the Gulf of Mexico, off the California coast, and Alaska.
- Cleanup Policy/Regulation Review
    - In-depth review by MMS of its oil spill contingency plan review, acceptance, and inspection procedures. A review of the effectiveness of the overall Federal response role in connection with potential OCS oil spills is also underway.
- Tanker Safety Analysis
    - Lujan requested a staff analysis of options for improving tanker safety, including the possibility of a radar communications system much like airport traffic control systems.
- Joint DOI/API Oil Spill Technology Research (also see page 18, API)
    - DOI and API will jointly fund a $6 million research and development program aimed at improving the technology and procedures for the containment and cleanup of oil spills. The costs of this program will be borne equally by API and the government over three years at a rate of $2 million a year.

Ed Tennyson
703-787-1559

ACTIONS IN RESPONSE TO EXXON VALDEZ OIL SPILL

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- The following proposals are being considered:
    - Quantify pollution trade-offs as a result of in-situ spill burning
    - Development of an airborne oil thickness sensor
    - Optimization of an innovative highspeed water jet containment boom
    - Development of nondamaging beachline clean-up techniques
    - Evaluation of an open ocean Finnish skimmer
    - Chemical treating agent improvements;
        A. Nondispersants
        B. Guidelines
        C. Dispersants
    - Development of a laser fluorosensor for oil detection
    - Development of a standard test procedure for offshore containment booms
- These activities will be coordinated with the Department of Transportation, the Environmental Protection Agency and the National Oceanic and Atmospheric Administration, with some work to be accomplished in cooperation with other countries. The $6 million program is only for research. The research will unquestionably uncover improvements in equipment and techniques for which additional spending will be required.

- Increase in Oil Spill Technology R&D — Ed Tennyson 703-787-1559
    - MMS plans to increase its annual budget for oil spill technology R&D by $1 million for fiscal years 1989-1991.
- Offshore Oil Spill Response Technology Seminar -- December 13, 1989 — Ed Tennyson 703-787-1559
    - Due to the increased interest and related inquiries into oil spill containment and clean-up technology since the Valdez oil spill, MMS conducted a seminar in Herndon, Virginia to discuss the current status of technology.
- Protocol for Post-Spill Studies — Don Aurand 703-787-1726
    - The MMS Regional Environmental Studies Chiefs will also be developing a protocol that describes how the MMS Environmental Studies program might participate in post-spill studies.

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- Incident Report

  Jan Thorman
  202-343-9314

  - OCS Policy Committee formed a sub-committee to review analyses of the Valdez oil spill and identify policy implications for the OCS oil and gas program. Report findings will be presented at the OCS Policy Committee meeting in the spring of 1990, in Alaska.

- Re-Opening of OHMSETT Facility

  Ed Tennyson
  703-787-1559

  - Working in conjunction with EPA and USCG, the MMS has been pursuing the re-opening of the Oil & Hazardous Materials Simulated Environmental Test Tank (OHMSETT), and oil spill testing facility in Leonardo, New Jersey, which closed in 1986 due to lack of funding. Negotiations are currently underway with the Navy, who took ownership of the facility in March 1989.

- Other actions in support of research:

  Jim Cimato
  703-787-1721

  - $56,000 and staff support has been provided to FWS to support aerial surveys of marine mammals and seabirds (focusing on sea otters). Radio tags have also been purchased for possible use on cleaned and released otters.
  - $10,000 has been provided to the National Marine Fisheries Service (NMFS) Auke bay (Alaska) laboratory to support that lab's sampling efforts in intertidal and subtidal areas of Prince William Sound (for subsequent chemical analyses).
  - $65,000 has been provided to various contractors to continue studies of the effects of the oil spill on the early life stages (eggs, larvae) of herring in Prince William Sound.
  - $50,000 has been provided to the National Oceanic and Atmospheric Administration (NOAA) to mobilize and transport the NOAA vessel #1273 from Prudhoe Bay down to Prince William Sound for use in field sampling efforts.
  - $50,000 has been provided to the United States Geological Survey (USGS) to redeploy their ship in Prince William Sound for the collection of sediment samples for chemical analyses.
  - $25,000 has been provided to contractors to deploy surface drifters along the trajectory of the Exxon Valdez to allow real-world verification of the drifter performance.

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- Offshore Oil Transport Stations

  Hank
  Bartholomew
  202-343-1398

  - Secretary Lujan has proposed that offshore "supports" be considered, at which tankers could unload without having to travel close to shore. The oil would then be transported to shore by pipeline.

- Marine Bird Surveys
  - The Fish and Wildlife Service (FWS) has been surveying beaches from vessels in the spill zone since March 27. The purpose of the initial surveys was to estimate mortality of seabirds and recover those fit for rehabilitation.
  - The FWS initiated aerial surveys for marine birds and mammals the day after the spill.

- Eagle Capture Program
  - Exxon has funded a program in conjunction with FWS to establish an eagle capture program designed to locate and retrieve bald eagles and other raptors impacted by the oil spill.

5 - Environmental Protection Agency (EPA)

Jim Makris
202-475-8600

- National Response Team
- National Resources Damage Assessment Trustee Council Consultant
- National Ocean Pollution Policy Board (NOPPB) Participation
- Oil Spill R&D Database

  Tony Jover
  202-382-2387

  - EPA is developing an automated database of all oil spill R&D activities throughout the public and private sector in the U.S. and internationally. Coordination with other oil spill related automated systems is planned. The data collection form will be circulated for review in late February 1990. Data collection will begin later in the spring.

- Bioremediation Project

  Hap Pritchard
  904-932-5311

  - EPA and Exxon tested a process last summer that uses phosphate and nitrogen to cultivate microorganisms on the beach. The process used in

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Alaska relies on the ability of naturally occurring microorganisms to degrade or break apart toxic hydrocarbons (such as those found in crude oil) in marine or other aquatic environments. Because it does not involve physical disruption of the site, bioremediation is an especially desirable technology for oil spill remediation.

- Workshop, December 14-15, 1989 – Scientific Critique of Bioremediation Research in Alaska

  Kurt Jakobson
  202-382-5747

  - EPA sponsored a workshop in Washington, D.C. which examined beach cleaning activities employed in Alaska. The purpose of the workshop was for EPA to 1) evaluate existing data and assess the extent to which nutrient addition enhanced oil biodegration and affected ecological processes, 2) identify information gaps, 3) identify overall conclusions and recommendations from the project, and 4) identify future bioremediation activities.
  - EPA concluded, based on visual inspection of treated beaches, that oil was removed from the shoreline. Samples of oil taken from the surface of treated beaches showed changes in composition indicating biodegration, and laboratory studies confirm that the use of bioremediation products enhanced the extent and rate of oil degradation relative to untreated shoreline materials.
  - EPA and Exxon continue to study the results of the bioremediation process in order to assess its effectiveness, potential environmental effects, and future use.

- Workshop, September 17-18, 1990 – Discussion of Various Aspects of Valdez Spill With Emphasis on Biological Clean-up Efforts

  Dr. Vlasta Molak
  Biotechnology
  Forum, Inc.
  513-533-8334

  - EPA, Biotechnology Forum, Inc., and others are sponsoring a workshop in Cincinnati, Ohio to enable participants to understand the extent of the spill in the context of environmental problems, to understand the complex chemistry of Prudhoe Bay oil and its implication for clean-up efforts, and to present clean-up options and evaluate them. Other presentations are designed to enable participants to understand the rationale behind biological clean-up efforts, to present the results of biological clean-up efforts by EPA and others and to examine the future of biological clean-up of oil spills.

- NETAC Review of Unsolicited Proposals

  Larry McGeehan
  412-826-5511

  - Following the Valdez oil spill there were a number of unsolicited

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bioremediation proposals forwarded to EPA. EPA recently asked the National Environmental Technology Applications Corporation (NETAC) to develop an evaluation system for reviewing these proposals. NETAC is a nonprofit corporation created in 1988 through an agreement between the EPA and the University of Pittsburgh to facilitate the commercial application of innovative environmental technologies.

- On December 18-20, 1989, NETAC assembled an independent panel of expert scientists from industry, academia, and applied research organizations to recommend criteria for choosing such technologies. The purpose of the evaluation system is to facilitate the movement of innovative biological approaches for dealing with oil spills more quickly into the marketplace. NETAC is now ranking all of the proposals against the established criteria and will be forwarding its recommendations to EPA and the USCG in early 1990.

- National Coastal and Marine Policy
  - EPA is convening an interagency group to arrive at consensus on a National Coastal and Marine Policy to focus on controlling or eliminating sources of pollution in coastal waters. One provision of EPA's draft proposal is to promote the acceptance of the international oil spill conventions.

6 - Department of Transportation/U.S. Coast Guard (USCG)

Capt. Richard
Larrabee
202-267-0518

- National Response Team Support
- National Resources Damage Assessment Trustee Council Consultant
- National Ocean Pollution Policy Board (NOPPB) Participation
- The USCG is investigating the Vessel Traffic System (VTS) and will address any circumstances that may have played a part in the spill.
- The Marine Board of Investigation is conducting a marine casualty investigation that will examine any evidence of wrongdoing on the part of the captain or crew of the Exxon Valdez. This investigation will determine if the Coast Guard will initiate suspension and revocation proceedings against the licenses or documents of personnel aboard the ship.

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- The National Transportation Safety Board is conducting a fact-finding investigation that can be expected to identify responsibility for the Exxon Valdez oil spill, as well as to make recommendations for avoiding such accidents in the future. An NTSB report typically requires 8 to 12 months for preparation.

- DOT submitted proposed oil spill legislation to 101st Congress. A description of DOT's proposal is included in Oil Spill Legislation summary attached.

- Current Studies

    - USCG currently has a number of navigation initiatives underway, including a port needs study. This study, expected to be completed in one year, will establish goals and priorities into the 21st century with a prioritized list of those U.S. ports and waterways that would benefit by having a Vessel Traffic System (VTS) or alternative management network established and a statement of the necessary capital investment. An operational and technical review of existing VTS's is underway to determine if near term changes are necessary. An in-depth technical and operational review of equipment will be conducted to identify needed upgrades or changes.

    - A pilotage study was recently convened to consider the need for changes to statutes and other requirements. The study will consider various determinations for pilotage including qualifications of licensed personnel, nature of voyage, type of cargo being transported, and type of service -- domestic or foreign. Additionally, the extent of pilotage waters, effect of vessel type on pilotage needs, certification and training, pilot/master authorities, and roles of federal and state governments will also be examined.

- Interagency Oil Spill R&D Workgroup

Dan Sheehan
202-267-2970

    - The U.S. Coast Guard has primary responsibility for the federal response to waterborne spills of oil and hazardous chemicals. In order to address U.S. concerns about oil and hazardous chemical-related research and development, the USCG sponsored a conference on September 26-27, 1989 at their R&D center in Groton, Connecticut. Representatives from nine federal agencies, API and PIRO attended. The conference examined R&D initiatives throughout the federal government and industry, and discussed methods for coordinating those efforts.

    - The USCG distributed proceedings from their September R&D conference in November 1989. A follow-up meeting was held on

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November 17.

  - The interagency workgroup expects to publish a report in early 1990, in response to oil spill legislation, that summarizes findings of the workgroup, identifies state-of-the-art R&D, future R&D needs, and makes recommendations for federal coordination of R&D efforts.

- FY90 Oil Spill Appropriations Increase

  - The USCG received an increase of $4 million in their FY1990 appropriation for oil spill prevention and response R&D. A spending proposal for the $4 million was submitted to Congress in November 1989.

7 - International Maritime Organization (IMO)

- The Paris Economic Summit in June 1989 issued a communique that "expressed concern that national, regional, and global capabilities to contain and alleviate the consequences of maritime oil spills need to be improved. All countries were urged to make better use of the latest monitoring and clean-up technologies and to adhere to and implement the international convention for the prevention of oil pollution of the oceans." The communique also asked the IMO to put forward proposals for further preventive action. In follow-up to the communique, the USCG has initiated the following objective:

  - Convening of an international conference by late 1990 to develop and adapt an international convention on emergency preparedness and response to oil spills from ships. This objective would build upon existing bilateral and regional plans, with key benefits derived from joint R&D and knowledge of existing equipment inventories.

8 - Department of Energy (DOE) — Rich Dailey 202-586-7117

- National Response Team Support
- Gasoline Price Impact Analysis
- Oil Supply Analysis

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- Joint DOE/State of Alaska Study on the Alaska North Slope Oil Delivery System (ANSODS)

Guido
DeHoratiis
202-586-7296

  - Joint study with the State of Alaska to provide information and to assess the long-term delivery capability of crude oil from arctic Alaska to destinations in the continental U.S. The following outlines the scope of the study:

    1. Potential Timetables for the Development of Arctic Alaska Oil
       A. Current arctic Alaska production and revenues
       B. Predictions of U.S. oil and gas demand and world prices
       C. Analyze future scenarios of oil development and demand on the existing system
       D. Arctic Alaska natural gas resource potential

    2. Technical Review of Past Performance, Current Status and Future of ANSODS
       A. Original design and performance specifications
       B. Actual performance record from 1977 to the present
       C. Design history
       D. Future performance requirements
       E. Trade-offs between potential development and facility requirements

    3. New Technologies for Spill Prevention, Containment, Mitigation and Cleanup
       A. Information on the state-of-the-art in spill technology in addition to new spill technology
       B. Effectiveness of this technology
       C. Identify techniques that may be adaptable to Alaskan conditions

    4. Consequences Resulting from a Shutdown of the ANSODS
       A. Review of the engineering and operational considerations
       B. Impact on producing fields due to shutdown

       C. Assess the loss of revenues to the industry, the state, and the federal government
       D. Impact of a reduced energy supply for the nation and the state

  - A meeting to finalize the statement of work and begin procurement for the study will be held in March 1990.

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- DOE Lab Capabilities — Jan Lane 301-353-2604

  - DOE is currently exploring the possibility of using the research capabilities of its National Labs in cooperation with other federal and industry research efforts. Work being done by DOE in the following areas may be relevant to other oil spill clean-up R&D underway or proposed:
    - microbial science related to enhanced oil recovery
    - biological methods of cleaning up oil and spills on land
    - R&D on cleanup of hazardous materials in Defense programs
    - remote sensing
    - instrumentation for detection and analysis
    - robotics
    - dispersion technology
    - major modeling capabilities

9 - International Energy Agency

- International R&D — Harold Jaffe 202-586-6770

  - The Secretary of Energy, representing the United States at the May 1989 International Energy Agency (IEA) Ministerial meting, called for an "international effort focusing on the prevention and handling of oil spills". This position derives from two principles fundamental to our national energy policy: to reduce our vulnerability to disruption in energy supply arising from political, accidental, or other causes; and to ensure that the supply and distribution of energy is carried out in an environmentally sound manner. Steps taken to reduce the occurrence of oil spills, and sound preparedness to deal with oil spills will enhance public confidence in energy development activities, minimize pressure for policies which may adversely affect energy security, and reduce the chance of such spills disrupting the oil supply infrastructure.

  - The IEA agreed to "examine the possibilities for international collaboration to improve technologies and procedures for preventing and treating oil spills and other accidents in the petroleum production, transport, and processing system." In response to the IEA commitment, the Committee on Research and Development (CRD) is surveying current efforts by international organizations, through the public and private sector to determine the extent of their involvement in this area.

  - The IEA is considering an international conference, possibly in Canada, in the Spring of 1990, to review oil spill R&D activities throughout the

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U.S. and internationally, to assist IEA in formulating its objectives.

10 - Department of Commerce (DOC)/NOAA

George Kinter
202-443-8865

- National Response Team
- National Resources Damage Assessment Trustee Council
- National Ocean Pollution Policy Board (NOPPB) Chair
- Clean-up Technology Workshop, November 28-30, 1989
  - As part of NOAA's winter program for the Exxon Valdez clean-up, a workshop was held in Anchorage, Alaska to examine technological methods which may be useful in dealing with oil remaining on the shoreline next spring. Each of the three areas of treatment technology -- physical, chemical, and biological -- were examined.
- Mussel Watch
  - A variety of intertidal sites in Prince william Sound have been revisited. Mussels and sediment samples are being collected for later chemical analysis.
- Benthic Surveillance
  - Fish and crustacea are being collected in Prince William Sound for subsequent chemical analysis of petroleum hydrocarbon concentrations and aryl hydrocarbon hydroxylase activity levels. This is an expansion, or refocusing, of NOAA's National Benthic Surveillance Project.
- Spring Clean-up Activities

Dave Kennedy
206-526-6317

  - NOAA compiled a draft paper on clean-up strategies which was distributed for review to other federal agencies. It was revised based on their comments and was submitted to the Coast Guard for their consideration in planning spring clean-up activities.
  - A multi-agency group (Exxon, State of Alaska, NOAA, Coast Guard and others) will be walking the beaches to assess their condition and determine needed clean-up activities. This assessment will begin the end of March.

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11 - Office of Technology Assessment	Peter Johnson 202-228-6848
• Oil Spill Technology Assessment	
- OTA is conducting an oil spill technology assessment that will provide background and guidance to the Congress when considering how to build a better oil spill response capability through Government programs, private incentives, or regulations. Such initiatives could take the form of research and development; construction of improved systems; better response planning; or enhanced drills, tests, and training. The OTA study will evaluate current capabilities in the U.S. and internationally, and identify the major gaps in capabilities that hinder an adequate national response in the future.	
- A draft report was distributed on December 20, 1989. Final publication is expected in March 1990.	
12 - State of Alaska	
• Participation in National Resource Damage Assessment Trustee Council	
• The Attorney General for the State of Alaska is investigating issues of negligence and liability resulting from violations of State laws.	
• Joint study with DOE to look at the Alaskan oil production and delivery system (See 8-DOE)	Dr. Henry Cole 907-465-3568
• Coordination with Alyeska to develop and implement new tanker rules (See 15-API)	Lynn Woods AOSC 907-258-6545
• The State legislature has passed a series of bills which would:	Lynn Woods AOSC 907-258-6545
- Increase civil fines for oil spills from $10 a gallon to as much as $50 a gallon. A cap on fines was also raised from $100 million to $500 million.	
- Prohibit oil companies from writing off spill cleanup costs on its severance tax payments. The bill would apply to Exxon's costs.	

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  - Require the Department of Environmental Conservation to prepare a statewide master plan for cleanup of oil spills and hazardous substance accidents. The law would require contingency plans for all coastal areas where the dangerous substances are moved on water.
  - Create an oil and hazardous substance response office that would use volunteer corps in coastal communities for the initial response to the spills.
  - Raise oil production taxes by a nickel a barrel to pay for all the oil spill legislation.
  - Create an independent commission to investigate the Prince William Sound oil spill.

- Alaska Department of Environmental Conservation (ADEC) Report

Alex Viteri
ADEC
907-276-1194

  - About 100 miles of shoreline segments will require additional treatment to remove oil contamination in Prince William Sound resulting from the Exxon Valdez oil spill. These areas are mostly low-energy shorelines that were heavily or moderately oiled and are likely to remain contaminated and present continuing risks to wildlife and fisheries. These areas are also likely to become covered with asphalt as the oil continues to weather.
  - Scientists were able to pinpoint these areas using the report prepared by ADEC and distributed in January to Exxon, the U.S. Coast Guard, and the National Oceanic and Atmospheric Administration. The report, entitled "Impact Maps and Summary Reports of Shoreline Surveys," includes maps that indicate the condition of Alaskan shorelines after Exxon clean-up crews had departed in late September.

- Data Sharing Agreement

Alex Viteri
ADEC
907-276-1194

  - A data-sharing agreement between ADEC, Exxon and NOAA, which was signed by all parties on December 13, 1989, is intended to facilitate the information exchange among the agencies responsible for deciding what oil clean-up activities should take place next spring.

- Alaska Oil Spill Commission

Lynn Woods
AOSC
907-258-6545

  - The Alaska Oil Spill Commission, created by the Alaska legislature to study the Valdez incident and recommend public policy remedies, recently completed its report. The report includes 60 recommendations

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on prevention policies, industry responsibilities, state and federal regulations and oversight, government response, and research and development.

- Winter Clean-up Efforts
  - Governor Steve Cowper approved in January more than $6 million in grants to communities affected by the Exxon Valdez oil spill in Prince William Sound last March. The funds will be used primarily for local oil removal, but will also finance administrative activities and preparation for shoreline treatment in the spring. The grants are part of a $21 million state winter clean-up plan announced by Cowper in September and are in addition to about $3 million already given to local communities.
- Meeting on Clean-up Methods – February 26-March 2, 1990

  Alex Viteri
  ADEC
  907-276-1194
  - The Alaska Department of Environmental Conservation has been working over the winter to identify efficient, cost-effective, environmentally sound clean-up methods. They have reviewed over 150 unsolicited proposals. These have been narrowed to 40 proposals for further consideration. 20 of those 40 concern bioremediation methods and have been forwarded to EPA for their review. The other 20 proposals are mechanical or combined mechanical/chemical methods of clean-up. These 20 proposals were considered at a meeting February 26-March 2 attended by representatives from the State of Alaska, the Coast Guard, NOAA, and Exxon.
  - Participants were shown videotapes of actual clean-up and where the oil is now. They determined the most promising clean-up proposals from the 20 still under consideration. If needed, these candidates will be field tested before being forwarded to the Coast Guard for consideration in their spring clean-up plans.

13 - National Academy of Sciences (NAS)

- **Assessment of Tank Vessel Design Alternatives**

  Dan Sheehan
  202-267-2970
  - The U.S. Coast Guard has requested the National Academy of Science's National Research Council to assess whether alternative tank vessel designs such as "double bottoms" or "double hulls" have the potential to improve maritime safety and marine environmental protection. A committee has been convened under the Marine Board to review the

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safety, economic and environmental implications of alternative tank vessel designs and make recommendations.

- Specific Tasks
    - Identify and define tank vessel design and arrangement alternatives to be considered;
    - Acquire data on and analyze tank vessel accidents;
    - Assess technical concerns about alternative tank vessel designs;
    - Identify needed research; and
    - Elucidate the safety, environmental, economic costs and benefits of alternative tank vessel designs.
- Report Preparation and Dissemination
    - The committee will prepare a report that addresses how alternative tank vessel designs might affect the overall consequences of tank vessel accidents. The Coast Guard will use the technical information, analysis and recommendations of the Academy in its deliberations concerning whether to establish new or alternative tank vessel design requirements as one measure to improve maritime safety and marine environmental protection. The results of the study will also be of interest to the United States Congress, to the domestic and international marine transportation industry, to environmental protection organizations, and to states and communities along tank vessel routes.
- Schedule
    - A pre-publication copy of the formally reviewed and released National Research Council report will be available to the U.S. Coast Guard in October 1990. Printed copies of the final report will be publicly available in February 1991.
- NAS will be producing an annotated bibliography on oil spill related R&D.

14 - Department of Defense (DoD)

• National Response Team Support	Brian Higgins 202-325-2211
• Alaska Regional Response Team Support	Mervin Mullins 907-753-2513

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- Department of the Army, Director of Military Support, Alaska Joint Task Force (DOMS JTF)

  LTC Don
  Willhouse
  202-695-3848

- U.S. Army Corps of Engineers (USACE), Emergency Management Branch

  Bob Fletcher
  202-272-0251

- DoD participated in development of the 3-Day Report to the President and is participating in the 6-Month Study and Report on Oil Spill Contingency Planning

- DOMS JTF coordinated DoD support for clean-up. DoD provided detailed Information Memoranda on a daily basis during the clean-up and is preparing an after action report.

- Alaska National Guard provided support under the direction of the Governor

- U.S. Air Force provided over $3 million worth of heavy airlift of clean-up equipment from around the world.

- NAVSEA SUPSALV provided over $30 million worth of equipment and personnel for clean-up.

- NAVSEA SUPSALV maintains oil and hazardous substance pollution response equipment and provides technical expertise and related support to predesignated Navy On-Scene Coordinators. Under the terms of the National Oil Spill and Hazardous Substances Pollution Contingency Plan, SUPSALV response assets are also available to Federal On-Scene Coordinators for non-Navy spill response.

15 - American Petroleum Institute (API)/Petroleum Industry

- Joint DOI/API Oil Spill Technology Research

  Bob Drew/API
  202-682-8308

  - DOI and API will jointly fund a $6 million research and development program aimed at improving the technology and procedures for the containment and clean-up of oil spills. The costs of this program will be borne equally by API and the government over three years at a rate of $2 million per year. The following proposals are being considered:

    - Quantify pollution trade-offs as a result of in-situ spill burning
    - Development of an airborne oil thickness sensor
    - Optimization of an innovative highspeed water jet containment boom
    - Development of nondamaging beachline clean-up techniques

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- Evaluation of an open ocean Finnish skimmer
- Chemical treating agent improvements (dispersants, nondispersants, guidelines)
- Development of a laser fluorosensor for oil detection
- Development of a standard test procedure for offshore containment booms

- These activities will be coordinated with the Department of Transportation, the Environmental Protection Agency and the National Oceanic and Atmospheric Administration, with some work to be accomplished in cooperation with other countries.

- API Task Force

John
Costello/PIRO
202-682-8580

  - The Board of API created an Oil Spill Task Force on April 7, 1989, to study and evaluate industry prevention and response programs. The Task Force, under the leadership of Allen Murray, Chairman of the Board, Mobil Corporation, consisted of officials from eight petroleum companies (i.e., Amoco, Arco, BP America, Chevron, Exxon, Mobil, Shell, and Texaco).
  - The Task Force recommended that the industry take action in three major areas: prevention of spills, response to spills, and spill-related research. The recommended program will cost the industry more than $400 million over its first five years. The Task Force recommended that the cost of the recommended program be funded by industry through a charge based on crude and fuel oil carried by sea and received by industry members at U.S. facilities.

- Task Force's Recommended Program

1 – Prevention - Areas of Focus:

E.J. Rollin
API Tanker
Committee
312-856-4810

- Vessel Traffic Systems
- Pilotage
- Tug Assistance
- Drug and Alcohol
- Crew Complement
- Automatic Pilot
- Vessel Configuration
- Vessel Size
- Licensing, Certification and Training of Marine Personnel
- Shipboard Oil Spill Response Capability

2 – Response to Spills (PIRO)

John
Costello/PIRO
202-682-8580

- The petroleum industry believes it can significantly enhance its response capability by providing greater availability of equipment and

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trained manpower through the establishment of a new organization to be known as the Petroleum Industry Response Organization (PIRO).

- The PIRO headquarters would be located in Washington, D.C. It would coordinate activities with the National Response Team, engage in research and training, and coordinate the five PIRO regional response centers. Each PIRO regional center would be manned around the clock with dedicated, trained personnel, and would have an 8 million gallon response capability.

3 – Oil Spill Research and Development Opportunities

John
Costello/PIRO
202-682-8580

- PIRO has agreed to provide $35 million over the next five years followed by a continuing effort of $1-4 million per year to fund research across a broad spectrum of issues. This research would be coordinated with that funded by the government and API to avoid duplication, gaps, and inefficiencies. PIRO is currently developing their R&D proposals.

- Based on contributions from industry and others, an overall program has been identified with six major objectives and prioritized to be executed over five years:

Objective	Estimated $k/Yr. Year 1 and 2	Estimated $k/Yr. Years 3-5
- Preventing Loss From/Away From Ship	150	150
- On-Water Oil Recovery and Treatment	2,650	1,850
- Preventing and Mitigating Shoreline Impact	3,450	1,675
- Fate and Effects of Oil in the Environment	2,100	1,100
- Wildlife Preservation	700	150
- Health and Safety	300	50
Total for Year	**9,350**	**4,975**
Overall for Period	**18,700**	**14,925**
Grand Total	**33,625**	

- **PIRO Implementation**

John
Costello/PIRO
202-682-8580

  - PIRO's steering committee has proposed an organizational structure and plan for implementation of an industry oil spill response organization. Comments and endorsements were requested by February 28, 1990. Organizational efforts will begin in earnest in March 1990.

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- A few of the specifics regarding PIRO's organization and response to spills will be determined based on the final language of the oil spill legislation developed by the House and Senate conferees.

- Oil Industry Safety Upgrade

  - The oil industry has acted to upgrade the safety of oil shipments in Alaska and is involved in a major effort to do the same in marine shipping operations elsewhere in the country.

- Alyeska - New Tanker Rules

  - Alyeska Pipeline Service Company, a group of oil companies that operates the oil terminal at Valdez, have undertaken a series of steps to improve spill prevention and response including:

    - Ship owners and operators using the Valdez terminal will be required to institute random drug and alcohol testing on all their vessels.
    - Tug escorts will be provided and pilotage will be requested on all incoming and outgoing vessels to a point beyond Bligh Reef in Prince William Sound.
    - Alyeska will propose to the U.S. Coast Guard the addition of the radar responder capability to the existing Bligh Reef buoy and other appropriate locations within Prince William Sound.

  - Alyeska has formed an around-the-clock oil spill response team at its Valdez Marine Terminal and has provided the terminal with equipment called for in its Oil Spill Contingency Plan.

  - Additional skimming and booming capacity will be acquired by Alyeska to augment the existing spill contingency equipment, in advance of a detailed study of contingency requirements.

  - Alyeska will assure the on-site availability of chemical dispersants and dispersant systems so they may be used in a timely manner in the event of a major spill.

  - Alyeska has acquired three large emergency response vessels to complement its oil spill response capability. The vessels are being modified for duty in Prince William Sound. They will escort outbound tankers within Prince William Sound and will be equipped to tow a vessel in distress as well as to immediately deploy oil spill recovery equipment in the event of a spill.

ACTIONS IN RESPONSE TO EXXON VALDEZ OIL SPILL

Contact/
Phone #

- Alyeska - Oil Spill Assessment

  - Alyeska is making a full assessment of its response to the spill to assure that all opportunities for improvement have been identified. A task force of Alyeska owner-companies will then make additional recommendations on such matters as improved cleanup equipment and spill management for Valdez and Prince William Sound. The task force's report will be completed within the near future, made public and promptly implemented.

- Evaluation of Ecological Effects

  - Beyond cleanup and mitigation efforts, ADEC, NOAA, Exxon and the petroleum industry are evaluating the short and long term ecological impacts of the spill. These organizations brought environmental experts to the scene to test the water column in affected areas, bottom sediments, and effects on marine life and shoreline habitats.

16 - Other Efforts

- National Fish and Wildlife Foundation

  - The national Fish and Wildlife Foundation announced that it is establishing a special fish and wildlife restoration fund to aid the rescue and recovery of fish, wildlife and plant resources impacted by the Valdez oil spill. The Foundation will manage the fund, and monies will be disbursed in concert with and on the recommendations of officials from the United States Fish and Wildlife Service, the National Marine Fisheries Service, and the Alaska Fish and Game Commission.

- Center for Marine Conservation — Linda Bennett 202-429-5609

  - The Center for Marine Conservation, a nonprofit organization, has released a report entitled "The Exxon Valdez Oil Spill: A Management Analysis." The report examines the response of each state and federal agency to the spill, and make recommendations on oil spill contingency plans, Alyeska's initial response, federal and state agency actions, Exxon's activities, oil spill liability, and funding for planning and response. The report also describes in detail the effect of the oil spill on wildlife in the region, and evaluates the efforts to rescue, rehabilitate, and release oiled wildlife.

ACTIONS IN RESPONSE TO EXXON VALDEZ OIL SPILL

	Contact/ Phone #
• Alaska Conservation Foundation	Jim Stratton 907-276-1917

- The Alaska Conservation Foundation has established two funds to accept citizen and corporate contributions in response to the Exxon Valdez oil spill disaster. The Prince William Sound Cleanup and Rehabilitation Fund supports citizen and volunteer efforts in all areas affected by the spill. Possible programs supported by this fund include identifying potential volunteers and their skills and expertise, providing support for volunteers, such as transportation, food, equipment and supplies, and providing public oversight of state and federal agency policy decisions. The Fund for Oil and Alaska's Future is to be used to fund proposals submitted by Alaskan environmental groups for supporting initiatives relating to the oil industry in Alaska. Projects could include review of contingency plans and advocacy for stronger enforcement of existing regulations.

Legislation in the 101st Congress

Overview

Oil spill legislation has been a topic in the U.S. Congress for years, but with little action. The Exxon Valdez spill of 10 million gallons of crude oil into Prince William Sound mobilized Congress for action and led to introduction of over 25 different bills related to oil spill prevention, response, liability, and clean-up. Many of these bills had similar provisions.

The Senate distilled the many oil spill bills offered into a single bill which was passed in August. The House followed suit with a bill of their own in early November. The two bills are now awaiting conference action, expected in early March. There has been some speculation that the recent spill off California will push Congress to take action and that it may be politically expedient to finalize a bill prior to the first anniversary of the Valdez spill in late March.

Legislation restricting offshore development have also been proposed as concern has grown over the impact of oil spills on the environment. Certain areas of the Outer Continental Shelf (OCS) have been placed off-limits for development as part of the Department of Interior appropriations bills annually since 1982. The number of areas suggested for moratoria have grown, and new bills would restrict development even further.

Senate Action

In the Senate, a single bill, S.686, was created from the many different oil spill proposals. This bill, entitled The Oil Pollution Liability and Compensation Act of 1989, was passed by the Senate on August 4, 1989. The original Senate bill was introduced by Sen. Mitchell (D-ME) on April 4, 1989. The bill was amended to include provisions from bills introduced by Senators Adams (D-WA), Stevens (R-AK), Kerry (D-MA), and Lautenberg (D-NJ).

Since the Senate bill combines provisions from many bills it contains provisions relating to response, liability, funding, research, and prevention.

- Response: Regional response centers will be established using existing public or private personnel. A National Contingency Plan will be established including criteria, standards and procedures for response and clean-up.

- Liability: Responsible party shall be liable for clean-up costs and damages, limited only as follows: tankers, $1000/gross ton; other vessels, $300-600/gross ton; offshore oil rigs, unlimited; other onshore and offshore facilities and the Trans-Alaska Pipeline System (TAPS), $350 million. Unlimited liability shall apply in all cases of willful misconduct or gross negligence. Acts of God, acts of war, and acts or omissions of a third party shall exempt the owner of the vessel from liability.

- Funding: Establishes the Oil Spill Compensation Fund. Absorbs the fund established by the Clean Water Act, the Trans-Alaska Pipeline Liability Fund, the Deepwater Port Liability Fund, and the Offshore Oil Pollution Compensation Fund. Fund would be used to provide immediate funding for clean-up and removal efforts (to be reimbursed by the responsible party), to pay claims in excess of the liability limits of the party responsible, and to pay for research efforts.

- Research: Establishes a research and development program on scientific and operational aspects of spill prevention, response, containment, and recovery with expenditures of up to $25 million annually. Priority shall be given to research on on-water oil recovery and treatment; prevention of loss from and away from vessels, including the use of values for such purposes and onshore and offshore facilities; prevention and mitigation of shoreline impacts; fisheries and wildlife protection, mitigation and recovery; and protection of public health and safety.

- Prevention: Requires a study by the Coast Guard on the effects of having double bottoms or double hulls on tankers as a prevention method. If found to be effective, new tankers would be required to be built with double hulls.

House Action

House of Representatives action in 1989 focused on two oil spill bills: H.R. 1465, introduced by Rep. Jones (D-NC) and H.R. 3027, introduced by Rep. Anderson (D-CA). Provisions from H.R. 3027 were absorbed into H.R. 1465, the Oil Pollution Act of 1989. H.R. 1465 passed the House on November 9, 1989 with a large number of floor amendments to incorporate provisions from other oil spill bills.

The major provisions of H.R. 1465 are listed below. Where appropriate, differences from the Senate bill are noted.

- Liability: Responsible party shall be liable for all costs and damages associated with clean-up. Liability shall be limited as follows: tankers, $1200/gross ton up to $10 million; other vessels, $600/gross ton; offshore facilities, $75 million; onshore facilities or deepwater ports, $350 million; unlimited liability in cases of gross negligence. These limits are slightly higher than those in the Senate bill. The Miller (D-CA)-Studds (D-MA) amendment proposing unlimited liability in the case of simple negligence was defeated in floor debate. The Dept. of Transportation and the oil industry had expressed concern over the Miller-Studds amendment, saying unlimited liability is uninsurable.

- Funding: Funding provisions are virtually identical to the Senate bill.

- Prevention: Requires double hulls on all new vessels built, and the conversion to double hulls on all other vessels within 15 years. (The House has directed their conferees to insist on this provision in the conference bill. The Senate bill only calls for a study of their feasibility.) The bill also adds restrictions on the number of hours in a shift, imposes greater compliance requirements with vessel traffic systems, and allows states to impose pilotage requirements.

- Clean-up: All vessels used to transport oil must have a spill contingency plan approved by the President within one year. A Fish and Wildlife Response Plan will be created as part of the National Contingency Plan.

- Research: Establishes an Interagency Coordinating Committee on Oil Pollution Research. The committee will coordinate a comprehensive program of oil pollution research, development and demonstration among Federal agencies, in cooperation with industry, universities, research institutions, State governments, and other nations, as appropriate. A minimum of 6 regional research centers will be established through competitive grants. Up to $28 million may be spent annually on research. For FY90-94, at least $1 million will be available for each regional center.

- International: The House bill does not provide for ratification of the international oil spill conventions, but does allow for the applicability of the international conventions if they are ratified in the future.

Administration Comments on the Proposed Oil Spill Legislation

The Senate and House bills have been circulated to various government departments and agencies for comment prior to the conference committee meeting. Several departments expressed concerns. The Department of Transportation (DOT) has attempted to incorporate these concerns into their response for the consideration of the Senate and House conferees. DOT supports the framework of H.R. 1465 and feels that S. 686 adds an unnecessary layer of supervision to oil spill response. DOT is concerned over the designation of the President as the responsible party for responding to an incident. Although the language differs, both bills contain this provision. DOT is concerned that this removes the responsibility from the spiller, and that spillers can use the Fund as a "bank" from which clean-up costs are "borrowed". H.R. 1465 provides spill responders with limited liability if directed to respond by the President, but not if directed by the spiller. DOT would like to see this limitation apply to all spill responders. DOT is very concerned over the provisions in H.R. 1465 requiring the Coast Guard to evaluate the maritime personnel programs of foreign nations and deny entry to tankers from nations determined to be "deficient". Not only is this difficult, but it detracts from international efforts to set and maintain high standards, and could lead to retaliatory measures. DOT prefers the Senate language on double hulls/double bottoms.

Several departments and agencies expressed concern over the additional responsibilities they would be charged with under such legislation. DOT points out that the Coast Guard's burden would be heaviest of all, with a lengthy list of new tasks assigned it by the bill. Existing resources in all agencies are spread thin, and conferees are asked to consider the burden this legislation places on agency budgets. This legislation will undoubtedly result in additional funding requests from most departments or agencies involved.

International Oil Spill Protocols

The House Committee on Foreign Affairs, Human Rights, and International Organizations has endorsed the ratification of the international oil spill protocols, although this provision was not included in the version of H.R. 1465 which was passed. The 1984 protocols to the 1969 civil liability and 1971 oil spill fund conventions were negotiated at U.S. insistence and raised the maximum shipowner liability from $18 million to $78 million. Total coverage per incident, including payments from the International Fund in excess of shipowner liability, was raised to $250 million. The Senate has previously refused to ratify the protocols because of concern over the possible preemption of coastal state oil spill liability laws. With the emphasis on state's rights shown in the debate on H.R. 1465, the House also appears reluctant to ratify the protocols this session.

The DOT has strongly urged Congress to ratify these protocols. A recent survey completed for DOT indicates the importance of ratification. With U.S. imports rising, the number of foreign tankers delivering oil to U.S. ports has grown 57% in the past 3 years. There is a trend among shipowners to be small operations, with few assets or other resources with which to pay damages in the event of a spill. DOT has indicated that unlimited liability provisions in the proposed oil spill bills would likely encourage a shift to single-asset foreign operations without assets in the U.S. Ratification of the international agreements would give the U.S. access to foreign assets to satisfy claims and would provide a uniform, predictable, and insurable worldwide liability and compensation system. In their response to the conferees, DOT has noted that only the House bill contains the joinder provisions necessary for the implementation of the protocols upon ratification. DOT urges that these provisions be retained in the conference version of the bill.

OCS Leasing Moratoria

Since 1982, leasing moratoria have been included by Congress in the annual appropriations bills for the Department of the Interior (DOI). The number of areas covered by these moratoria have grown. After the Exxon Valdez oil spill in March 1989, OCS leasing moratoria have been proposed for a number of areas as a way to prevent spills. The FY90 DOI appropriations bill included the largest number of leasing moratoria to date.

OCS leasing moratoria included in the FY90 DOI appropriations bill cover seven areas in the North Aleutian Basin, offshore California, the North Atlantic, the Mid-Atlantic, and the Eastern Gulf of Mexico off the coast of Florida.

- North Atlantic: The area covered includes the seabed shallower than 400 meters in the Georges Bank area. Interior may not conduct "preleasing and leasing activities."

- Mid-Atlantic: The area covered includes the first 50 miles off the Atlantic coast from Maryland to Massachusetts. Interior may not conduct "leasing activities" (including issuing a notice of sale) and may not issue permits for test wells or seismic surveys using explosives.

- Eastern Gulf of Mexico: In the area south of 26 degrees N. latitude, the Secretary may not issue a final notice of sale for Sale 116, Part II. Also, the Secretary may not approve "drilling or other exploration activity" on 73 existing leases.

- Offshore California: Three areas off California are currently restricted. For the lease sales in Southern California (Sale 95) and Northern California (Sale 91), Interior may not issue a draft environmental impact statement (EIS) until June 1990. For those sales, Interior may not issue a final EIS during the fiscal year. Interior also may not permit test well drilling or seismic surveys using explosives in the areas of Sales 95, 91, and 119 (Central California).

- North Aleutian Basin (Bristol Bay): Interior may not allow "drilling or other exploration activity" on the 23 existing leases and may not conduct "leasing."

Additionally, in the conference report (but not in the text of the appropriations law) Congress has asked the Secretary of the Interior to report by March 1, 1991 on three issues related to leasing in the North Aleutian Basin in Alaska. These include a study of the effects of the Valdez spill on fisheries and application of these findings to Bristol Bay fisheries, a determination of whether oil spill contingency plans for the area are adequate for "a maximum volume spill during the exploration phase," and a study of options for "the possible repurchase" of existing leases in the area. DOI is to recommend whether Congress should exercise any of these repurchase options.

CZMA Reauthorization

The Coastal Zone Management Act is up for reauthorization in Congress this year. Rep. Jones (D-NC) has introduced H.R. 4030 which would reauthorize the CZMA and overturn a 1984 Supreme Court decision which allows the federal government to conduct offshore lease sales over the protest of coastal states. The CZMA requires that federal offshore activities be consistent with state coastal zone management plans. The Supreme Court decision states that OCS lease sales do not directly affect coastal states. Industry and the Interior Department have reacted negatively to the proposal and debate will likely be heated. Offshore leasing has become such a hot topic as an adjunct to discussions on oil spills, that some in Congress may consider reopening the Outer Continental Shelf Lands Act. Although it is unclear whether this action will be taken, or how far Congress would be willing to go, any reopening would likely lead to much more restrictive leasing and development practices.

Other Legislative Actions Affecting Offshore Development

H.R. 3751, introduced by Rep. Boxer (D-CA) prohibits DOI from issuing a lease, permit or license for exploration for or extraction of oil or gas from the covered areas. Areas where activities would be prohibited include a 50-mile buffer zone off the coasts of Maryland and Massachusetts; a 100-mile buffer zone off the coasts of Florida, Georgia, South Carolina, Virginia, Delaware, New Hampshire, Maine, Washington, Oregon and Alaska; a 125-mile buffer zone off the States of New Jersey, New York, Connecticut and Rhode Island; a 145-mile buffer zone off the coast of California; a 175-mile buffer zone off the coast of North Carolina; and to all areas outside these zones where past Congressional moratoria have occurred. The bill also directs DOI to buy back the 73 existing leases in the eastern Gulf of Mexico south of 26 degrees North latitude and the 23 existing leases in the North Aleutian Basin. Alternative options are also to be developed for compensating leaseholders on the blocks comprising the proposed Mobil exploration unit offshore North Carolina.

H.R. 3861, introduced by Rep. Jones (D-NC) was prompted by Mobil's plans to explore its leases off the coast of North Carolina. The bill would prohibit leasing, exploration, and development off the coast of North Carolina. Rep. Jones argues that the environmental impact statements (EIS) issued by DOI prior to leasing are too old to provide reliable estimates of the current environmental impact of drilling in the area and that not enough is known to adequately protect this environmentally fragile area. Mobil's environmental report to DOI, dated November 1989, is also considered inadequate. The bill would therefore prohibit the Secretary of the Interior from issuing any new leases, approving an exploration plans, approving any permit to drill, or permit any drilling for oil or gas on any lands of the OCS offshore North Carolina.

It is unclear whether either of these bills stands a chance of passage this session. With the recent oil spill off the coast of California, environmentalists will likely push for some action relative to California. Interior Secretary Manual Lujan in mid-February appealed to Congress to lift its current bans on new OCS development and to open the Arctic National Wildlife Refuge for leasing, stating these resources were needed to meet the objectives of the national energy strategy. While it is unlikely that all bans will be lifted, leasing will certainly be a topic for Congressional action during 1990.

Southwestern Public Service Company

Question: As I understand it one of the projects selected in Round 2 proposed by the Southwestern Public Service Company would convert a gas fired power plant to a coal fired facility. This project has met with some opposition from a few environmental groups with respect to the increased emissions caused by converting from gas to coal. As I understand it in reality the emissions for this project would be considerably below the standards mandated for Phase 2 in the Administration proposed Clean Air Act. Is that accurate?

Answer: The Administration's proposed Clean Air Legislation for Phase 2 emission reduction would equate to an average emission rate of 1.2 lb SO2/Million Btu for all coal-fired plants. The Southwestern Public Service Company Nichols Station Clean Coal Technology Project is presently permitted to operate at 0.6 lb SO2/Million Btu with expectation of actual operations at about 0.4 lb SO2/Million Btu.

However, the Nichols Station is a gas plant and the Administration's proposed Clean Air Legislation baselines operation in 1985 when this unit was operated at a low capacity factor (10%). This translates to a required emissions level of about 0.12 lb SO2/Million Btu in the absence of allowances. Consequently, Southwestern Public Service Company would have to purchase allowances for this project.

Question: Is it true that this project is fully permitted by EPA?

Answer: Yes, the project is fully permitted by the EPA having undergone a Prevention of Significant Deterioration Applicability Review.

Question: Is it accurate that a comprehensive Environmental Information Volume was prepared through the NEPA process and based on this information an Environmental Assessment was made with an accompanying Finding of No Significant Impact (FONSI)?

Answer: Yes, a draft Environmental Assessment was circulated to the public and a proposed Finding of No Significant Impact was published in the Federal Register on December 15, 1989.

Question: Did EPA support the FONSI?

Answer: Yes, the Environmental Protection Agency supported the Finding of No Significant Impact by letter dated June 16, 1989.

Question: Did the only negative comments come from Washington, D.C. environmental groups?

Answer: Yes, the only four negative commentors were the Washington, D.C., based organizations of Trout Unlimited, National Wildlife Federation, Natural Resources Defense Council, and The Wildlife Society.

Question: Were favorable comments received from the region where the project would be located?

Answer: All comments received from the local region on the draft Environmental Assessment/Finding of No Significant Impact were favorable. A total of 23 favorable letters were received.

Question: What did the Programmatic Impact Statement estimate the overall nationwide SO2 emissions reductions to be from maximum deployment of this technology?

Answer: The Programmatic Environmental Impact Statement estimated a 44% reduction in SO2 nationwide from maximum deployment of the atmospheric fluidized bed combustion technology.

Question: Has Southwestern Public Service Company indicated they will withdraw the project if required to do an EIS?

Answer: The Southwestern Public Service Company indicated by letter dated August 3, 1989, and subsequent discussions that they would withdraw in the event of an Environmental Impact Statement is required to satisfy National Environmental Policy Act compliance.

The Department subsequently has notified (April 13, 1990) the Southwestern Public Service Co. that it will require an EIS for the project as part of the NEPA process. No reply has been received as yet that would indicate any final action to be taken by them.

Question: Would this project be the first commercial scale Circulating Fluidized Bed?

Answer: This would be the first demonstration of circulating atmospheric fluidized bed combustion (CAFB) at a scale (250 MW) commensurate with making a major market penetration into the utility sector. Currently, under the Clean Coal Technology Program, Colorado-Ute Electric Association is operating a 110 MW CAFB (at present the largest in operation). The CUEA project has stimulated other utility projects at comparable scale. The utility industry is awaiting a similar data base at the 250 MW scale before proceeding.

Question: Did the Clean Coal Technology program envision certain situations where a project might produce initial but slight increases in emissions as part of the effort to achieve the longer term goal of the program?

Answer: The Clean Coal Technology Program did envision, and did not preclude, the possibility of a demonstration that might produce initial but slight increases in emissions in order to meet the longer term goals of the program. The Clean Coal Technology Program does not envision, and the proposed Clean Air Legislation precludes widespread displacement of gas-fired electric utilities by coal-fired units.

STRATEGIC PETROLEUM RESERVE

Question: The Administration has asked Congress for authority to negotiate leasing agreements on crude oil to continue to fill the Strategic Petroleum Reserve. According to your Report to the Congress on Alternative Financing Methods for the Strategic Petroleum Reserve the Department has held discussions with several Middle Eastern oil producing countries, as well as with Norway, Mexico and the U.K., while "less detailed" discussions were held with Venezuela. Don't you believe that the potential advantages of such an arrangement with Venezuela -- to both of our countries -- deserve at least as much consideration as a leasing arrangement with the Middle East?

Answer: We do intend to hold the same kind of discussions concerning potential, cost-effective SPR leasing with Venezuela that we held in the Middle East, and with Norway, Mexico and the U.K.; however, as of this point, we have not been able to arrive at a mutually convenient time for such discussion.

Question: The DOE SPR size report concluded the SPR will be adequate when it is expanded to 750 million barrels, as opposed to the original maximum amount of one billion barrels. Relying solely on direct purchases, completing fill of a 750 million barrels reserve by 1996 would cost about $3.5 billion in oil purchases alone. Filling to one billion barrels by 2005 would cost $15 billion. If the Administration's suggestion is accepted, it would generate a substantial savings. What was the basis for the original SPR maximum fill amount of one billion barrels?

Answer: The 1975 Energy Policy and Conservation Act (EPCA), Public Law No. 94-163, authorized the creation of a Strategic Petroleum Reserve for the storage of up to one billion barrels of petroleum products. The one billion barrels is the maximum size authorized and it was not based on an objective cost benefit analysis. The EPCA required that a SPR of approximately 500 million barrels be developed by 1982. The 500 million barrel size was based on the total volume of crude oil imported into the U.S. in the three consecutive months during the 24-month period preceding the date of enactment of EPCA in which the average monthly import levels were the highest. The legislation also called for a SPR Plan to detail, among other things, the volumes and types of petroleum products to be stored. The SPR Plan submitted to Congress in 1977 recommended a Reserve size of 500 million barrels of centralized crude oil storage based on a wide range of factors.

In 1977 the Carter Administration National Energy Plan included a 1 billion SPR. The subsequent 1978 SPR Plan Amendment No. 2 amended the SPR Plan to increase the Reserve size goal to one billion barrels based on the need perceived by the Carter Administration at that time. This perceived need was not based on an objective, complete cost/benefit analysis. Subsequently the Administration proceeded with implementation of a 750 million barrel SPR. Plan Amendment No. 2 included a plan for achieving 750 million barrels but deferred action on the remaining 250 million barrels because of concerns about its need and value to the nation. Reassessments that included objective cost/benefit assessments in 1982 and 1986 supported the 750 million barrel size as did a 1987 DOE report to the President on energy security. The Bush Administration policy has been to complete a 750 million barrel SPR. The extensive analysis of economic, national security and foreign policy factors contained in the interagency study forwarded to Congress on February 2, 1990, reaffirmed the 750 million barrel goal.

Question: In your February 1990 Quarterly Report you estimate the cost to complete the SPR total inventory of 750 million barrels in the year 2000. Total cost is estimated at $5.1 billion for the development, operation and management of the Reserve and $19.5 billion for oil fill through fiscal year 1999. How do you explain your estimating $3.5 billion to fill to 750 million barrels by 1996 (in the SPR Size Report) and then estimating $19.5 billion to fill to 750 million barrels by the year 2000 (in your Quarterly Report)?

Answer: The $3.5 billion figure quoted from the size study is the estimated cost of purchasing 150 million barrels of oil to go from a 600 million fill level to 750 million barrels of oil. The $19.5 billion figure quoted from the SPR Annual/Quarterly Report is the estimated total cost of the entire 750 million barrels of oil in the completed SPR. The Annual/Quarterly Report also states that the cost of the first 577.1 million barrels of oil placed in the SPR is $15.8 billion. This implies that the remaining cost to go from 577.1 million barrels to 750 million barrels in storage will be $3.8 billion, a figure consistent with the $3.5 billion figure from the size study.

Question: Our imports of oil keep rising, as a matter of fact we just broke the record this past January. Oil imports constituted 54% of our domestic consumption. Did your analysis predict this level of increased dependence on foreign oil?

Answer: Imports in January were unusually large due to the need to replenish inventories of petroleum products, principally distillate fuel oil, following the extremely cold December (when imports were only 40% of consumption.) Gross imports for 1989 averaged 46% of demand, and following the unusually high import level in January 1990, preliminary estimates for February indicate a gross import level which is also 46% of demand. In general, DOE has projected a trend of increased imports and our projections have been reasonably accurate in the past few years for several years into the future.

Question: Have you done any analysis of the lowest amount of SPR fill that would still provide for sufficient national security?

Answer: It is not feasible to estimate a "minimum" SPR level based on the SPR Size study analysis, or to apply the methodology and assumptions of the recent study to examination of SPR size below 600 million barrels. The Analysis of Size Options assessed the quantifiable economic costs and benefits, the nature of possible disruptions, their sizes, frequencies, durations and probabilities and strategic factors such as foreign policy flexibility, associated with two SPR size increments: 600 to 750 million barrels and 750 million barrels to one billion barrels.
It was the judgment of the Administration that, given the economic and statistical analyses, assumptions used, and multiple sensitivity case analyses, the SPR size of 660 million barrels at the end of 1990 and its planned eventual size of 750 million barrels provide an effective response measure capable of offsetting the effects of a severe interruption of petroleum supplies. When all offsets, including coordinated stockdraw, are considered, disruptions several times larger than those that occurred in the 1970's can be mitigated.

Question: The Oil & Gas Journal states the DOE found the world is better prepared to deal with an oil supply interruption today than it was in 1979. The International Energy Agency member countries have built strategic stocks totaling nearly one billion barrels and 9-13 million barrels per day of surplus world productive capacity which could be tapped in the event of a disruption. How long will it take to actually tap these stocks? Will they be accessible to the U.S. and at what price?

Answer: As in the United States, the drawdown of emergency reserves by other IEA member countries would be initiated by a decision by their governments. Most IEA members state that they are prepared to reach such a decision within two or three days, although several say that it will take about a week. Following such a decision, strategic stocks in most countries would be available immediately. Additionally, some 780 million barrels of commercial stocks held by companies at refineries and storage terminals could be drawn down and processed or distributed as part of the normal course of industry operations. Some countries (e.g., Germany) hold a large portion of government-controlled stocks in separate stockholding entities, but these storage sites are well integrated into their petroleum distribution systems. As the world oil market is highly integrated, any increase in the volume of available oil, no matter what the source, will serve to mitigate a disruption. While the United States might not receive the physical barrels released from other members' reserves, the operation of the market will effectively increase U.S. and all other countries' supply as a result of such drawdown. Prices will be determined by prevailing market conditions.

DOE's current estimate of world unused production capacity is 5 to 6 million barrels per day, which is expected to decline in the future as worldwide demand for oil grows. Some of this is likely to be produced as was the experience for interruptions of the 1970s. In addition, fuel switching can also be expected to occur as the market quickly adjusts to a change in oil prices.

Question: Did your analysis include the events in Eastern Europe and the Soviet Union and the effect that the projected growth of their economies will have on demands for the world energy supplies? How will this demand effect our ability to tap into this IEA strategic stock?

Answer: The analysis reflects the energy projections presented in the International Energy Outlook 1989 (IEO89) which was published in March 1989. Thus, the analysis was undertaken before many of the major events in Eastern Europe and the Soviet Union had occurred. Developments of energy demand and supply in the Centrally Planned Economies (CPEs) were considered in the IEO89 in order to project net oil exports from the CPEs to the Market Economies. Net CPE oil exports were projected to decline from 2.4 million barrels per day in 1988 to 1.5 million barrels per day by 2000.

The IEO90 provides more detailed projections of energy demand and supply in the CPEs. These projections are based on analyses of energy reserves and forecasts of economic growth. At this point, it is difficult to predict how events in Eastern Europe and the Soviet Union will affect the underlying assumptions about economic growth and energy demand used in IEO90. The CPE oil exports to the Market Economies are still projected to decline to 1.5 million barrels per day in 2000, as they were in IEO89, and to decline to zero by the year 2010. Declining oil reserves, primarily in the Soviet Union, are expected to be used to meet growing demands in the CPEs. However, as CPE exports of oil become less important to the Market Economies over time, IEO90 projects that CPE exports of natural gas should become more important, particularly to Western Europe.

Question: Have you conducted any analysis of what can be done to encourage our allies to build more substantial strategic stocks?

Answer: Over the years, the U.S. has continued to stress to its IEA partners the need to maintain high levels of strategic stocks, and the economic benefits of releasing stocks early in a disruption, and in large volumes. Virtually all IEA members now agree that stock drawdown should be the first line of defense in a disruption, which is in contrast to their previously held position that the use of stocks was a measure of last resort. Further, several key IEA countries, notably Germany, Japan and the Netherlands, have established government controlled stockpiles, though not at levels fully commensurate with those of the U.S., thus ensuring that these volumes could be available for use in an emergency. The U.S. will continue its efforts to encourage its IEA partners to increase their emergency reserves stressing that each importing nation must share the burden of maintaining strategic stocks.

QUESTIONS SUBMITTED BY CONGRESSMAN LES AUCOIN

Advanced Materials

Question: Mr. Secretary, you and Deputy Secretary Moore have stated the importance of advanced technology to improve the efficiency of coal utilization. Could you discuss the Department's plans and programs for advanced technology for fossil fuels?

Answer: The AR&TD Materials program is directed to attaining a fundamental understanding of materials and how they perform in the hostile fossil environments. The program supports generic research of new materials, ideas and concepts to significantly improve the performance of existing fossil systems and the development of new systems and capabilities. High risk but high payoff research is pursued to enable major improvements in the cost, reliability, efficiency and environmental performance of fossil systems.

The program has four major thrust areas. These are Ceramic; New Alloys; Corrosion, Erosion Research; and Technology Development and Transfer. The Ceramics thrust includes structural ceramic composites for high temperature corrosive and erosive applications, solid state electrolyte systems, catalyst support materials, ceramic membranes, and ceramic filters. New Alloys research currently entails research on advanced austenitic alloys, iron aluminides and coatings and claddings. The Corrosion, Erosion thrust involves fundamental causation studies. Technology Development and Transfer provides for program formulation and emphasis to effect the materials technology transfer to industry and fossil line program applications.

Question: What are the technological opportunities in advanced materials for fossil energy applications?

Answer: Structural ceramic composites will provide the technology to significantly improve the fracture toughness of ceramics. This will permit their use in high temperature and/or corrosive, erosive environment structural applications such as heat exchangers, gas stream cleanup equipment and heat engines for more efficient systems.

The solid state electrolyte research offers opportunities for lower cost, high quality ceramic powders, highly efficient and flexible fuel cells, hydrogen and oxygen gas production, gas separation, sensors and new chemical systems.

Catalyst support materials research offers the potential of increased catalytic performance for lower cost production of liquids from coal. Ceramic membrane research offers the opportunity to capitalize on the results of extensive uranium gaseous diffusion technology research to develop rugged membranes for gas separation, hot gas stream cleanup to remove acid and green house gases (CO_2) and oxygen and hydrogen production for fossil/commercial applications.

Composite ceramic filters will provide highly reliable and efficient particulate cleanup of high temperature gas streams.

Advanced austenitic alloys will allow the production of higher temperature steam heat exchanger and combustion equipment for more efficient, lower cost power production.

Iron aluminides offer excellent oxidation corrosion resistance, sulfidation resistance second to no other alloy, and high temperature strength at low cost for many potential fossil systems and commercial applications. Coatings and claddings offer the potential of obtaining high corrosion or erosion resistance at low cost of all types of equipment and component applications.

Technology transfer provides specific efforts to accelerate the transfer to developed materials technology to industry, and thereby ensures commercial availability for subsequent fossil applications and to enhance U.S. industrial competitiveness.

Question: If you had additional resources in advanced materials technologies, how would the Department use them?

Answer: The funding request provides sufficient funding to maintain a balanced program. However, if additional funding resources were appropriated they would be applied to those developments which would lead to the earliest and/or most significant fossil/commercial impact. Depending on the magnitude of the additional resources provided, research would be accelerated/expanded on one or more of the following: iron aluminides, ceramic membranes, solid state electrolytes, catalyst support materials, ceramic filters and electrospark coatings. New initiatives could also begin on advanced materials processes or technology transfer of the iron aluminides and advanced austenitic alloys.

Fuel Cells

Question: You have put $50 million to date into molten carbonate fuel cell stack development and testing in order to get in front of foreign competitors in developing this technology and having it ready to be applied to meet additional power needs in the future. What is the Department's position of funding full-scale stack development, field testing, and assisting with other activities that are essential to getting molten carbonate technology closer to being a commercial product?

Answer: The Department is proceeding in FY 1990 with competitive selection of two cost-sharing contractors for molten carbonate system/stack scaleup as well as a third cost-sharing contractor to perform research on stack problem areas. These are expected to be three year contracts resulting in full scale stacks and modules applicable to field testing in a pilot system.

It is expected that field testing will involve substantial participation by the private sector and that final commercialization will be accomplished by the private sector.

Question: How would you feel about this work if there is substantial private sector cost-sharing?

Answer: The Department is in favor of substantial private sector cost-sharing in the development activities leading to commercialization. Private sector cost-sharing is expected to increase as these technologies move closer to commercialization.

Question: Please provide the Committee with the timetable and technical parameters for the competitive procurement anticipated this year to select two molten carbonate contractors for continued technology development support.

Answer: Proposals were received by February 20, 1990, and contracts are expected to be awarded by the end of FY 1990.

The technical parameters to be considered in selecting these contractors are centered around their abilities to provide fuel cell systems which will be competitive with other advanced systems.

Question: Do you anticipate that your funding request will be sufficient for full funding of the two contractors and to sustain current activity levels.

Answer: The FY 1991 request provides a total of $5,685,000 for molten carbonate systems. This would continue the two cost-shared system/stack contractors selected in FY 1990 at a reduced level of effort.

Question: What will be the nature of the third "support" contract that you plan to award?

Answer: The third contract is expected to provide research to solve remaining stack problems and increase stack performance and reliability. Several areas expected to be addressed are corrosion, electrode stability and electrolyte migration. Solutions should be applicable to other molten carbonate systems being developed.

FOREIGN COUNTRIES PRODUCING OVER OPEC QUOTAS

In recent months, there have been reports in the press of a number of foreign countries exceeding their OPEC quotas. While many of these reports may be true, the number of countries exceeding their quotas at any pariticular time may vary from month to month. The Department recently has received reports of nine OPEC producers producing above their quotas.

PERCENTAGES OF OPEC COUNTRIES' INCOMES PRODUCED BY AN SPR LEASE

The percentages would depend upon a number of factors in addition to the production levels of each country. The critical factors would be the lease rate, the world price of oil, and the size of the lease. To illustrate the changes, the Department used average daily oil production for the first 11 months of 1989, and calculated annual incomes for four OPEC countries with which discussions have been held on the issue of leasing. It was also assumed that the Department would lease 100 million barrels of oil at annual lease payments of $0.50, $0.75, and $1.00 per barrel. The lease payments as a percentage of oil income are shown in the following tables. In no case does the lease payment reach one percent of annual oil revenue for any of the four countries.

PERCENTAGE OF INCOME FROM A 100 MILLION BARREL LEASE TO THE SPR

SAUDI ARABIA

	COST PER BARREL OF LEASE OIL PER YEAR		
WORLD OIL PRICE	$0.50	$0.75	$1.00
$16.00	0.17%	0.25%	0.34%
$18.00	0.15%	0.22%	0.30%
$20.00	0.13%	0.20%	0.27%

KUWAIT

	COST PER BARREL OF LEASE OIL PER YEAR		
WORLD OIL PRICE	$0.50	$0.75	$1.00
$16.00	0.48%	0.72%	0.96%
$18.00	0.43%	0.64%	0.86%
$20.00	0.39%	0.58%	0.77%

UNITED ARAB EMIRATES

	COST PER BARREL OF LEASE OIL PER YEAR		
WORLD OIL PRICE	$0.50	$0.75	$1.00
$16.00	0.45%	0.67%	0.89%
$18.00	0.40%	0.60%	0.79%
$20.00	0.36%	0.54%	0.71%

VENEZUELA

WORLD OIL PRICE	COST PER BARREL OF LEASE OIL PER YEAR		
	$0.50	$0.75	$1.00
$16.00	0.46%	0.68%	0.91%
$18.00	0.41%	0.61%	0.81%
$20.00	0.37%	0.55%	0.73%

COST TO MAINTAIN THE SULPHUR MINES SITES

The cost for standby operations, maintenance, security and environmental activities at the Sulphur Mines site is approximately $4 million per year.

DEFERRAL OF FACILITY ENHANCEMENTS

Three large capital intensive projects constituted the majority of the FY 1991 Program Planning Level, requested by the Office of Naval Petroleum and Oil Shale Reserves. The Department made the decision to attempt to fund these capital projects outside the Federal budget process through private sector financing. The three projects and their estimated costs were:

Project	Cost
Gas Operations Expansion Project	$81.6 million
Butane Isomerization Facility	$10.9 million
NOSR Gas Protection Program	$10.7 million

ULTIMATE RECOVERY

Implementation of the gas plant has no bearing on the ultimate recovery of hydrocarbons from any of the NPRC reservoirs, since the production of that additional oil and liquid natural gas is not rate sensitive. Deferral of the gas operations expansion project does, however, constrain field-wide gas handling capabilities and implementation of associated production strategies. Paramount among those strategies is the cycling of gas through the 26R reservoir so that additional natural gas liquids can be processed and sold. Additional gas capacity will also allow the field to produce a number of wells shut-in because of the high volumes of gas produced with oil. It is estimated that if capacity exists to process that gas, an additional 4000 barrels of oil per day could be produced from shut-in, high gas/oil ratio wells.

COST OF BUILDING FACILITIES

The cost of building the gas operations expansion program has been estimated to be approximately $82 million. It should be noted that there are several distinctive component projects associated with that cost. They are: a 100 MMCF/D low temperature separation plant; an expanded pipeline system; gas injection facilities; liquid natural gas sales facilities; and a variety of retrofits and upgrades to the existing gas processing system.

PRODUCTION AND REVENUE

Implementation of the Department's gas protection plan will yield the following production and estimated revenue streams:

Year	Production (Million Cubic Feet)	Revenue ($000)
1991	3,104	$ 3,725
1992	6,410	8,141
1993	13,728	18,396
1994	13,423	18,926
1995	11,388	16,854
1996	8,665	13,431
1997	7,109	14,218
1998	5,846	12,335
1999	4,813	10,685
2000	3,976	9,463

Only the first 10 years are shown. Production and revenues will gradually decline throughout project life of 20 years. Revenues are based on a gas price of $1.20 per thousand cubic feet in 1991 with moderate annual increases.

NAVAL OIL SHALE RESERVES DRAINAGE

Basis	Naval Oil Shale Reserves Drainage thru 2015 (Million Cubic Feet)	Lost Revenue (Million)
Existing wells, to date	3,650	$ 5.475
Existing wells, no future activity by private industry or DOE	7,353	10.030
Existing wells scheduled FY 90 wells by private industry, no DOE activity	19,584	29.376
Existing wells, full development by private industry, no DOE activity	58,656	87.984

Revenues are based on an average gas price of $1.50 per thousand cubic feet over the period 1989-2015. Drainage estimates are based on the results of simulation studies performed by the Department in 1985 and 1987.

COSTS TO IMPLEMENT

The Department's costs to implement our gas protection plan in FY 1991 would be $10.7 million and in FY 1992 would be $34.2 million.

PAYBACK OF $4.4 MILLION REPROGRAMMING

The NOSR Gas Protection Program is designed to prevent the drainage and ultimate loss of natural gas resources underlying the government property to contiguous private developers. In the past eight years, it is estimated that drainage has resulted in the loss of over $5 million worth of government natural gas. This development has intensified measurably in the past two years and could account for as much as $55 million in drainage losses in the next ten years.

The $4.4 million reprogramming is specifically for communitization (joint ownership) of wells proposed by private developers for drilling in areas contiguous to the government's property. Twenty-seven such wells have been proposed by private developers for drilling in FY 1990. Failure to participate in the cost of these wells would result in a three hundred percent penalty in revenues before the DOE would be entitled to share in the production. In otherwords, if DOE were a 50% owner of the wells, at a total cost of $4.4 million, the penalty would be $13.2 million in production revenues before the government would be entitled to its share of production. With the very rapid decline of production experienced by these wells, the government would likely never be able to recoup its share of the gas over the remaining life of the wells.

If DOE does participate in all 27 wells, it will collect receipts that are estimated to be $20.4 million over twenty years. Payback of the initial investment would be made in approximately 5.5 years and the discounted net present value of the investment would be $2.9 million. The government's share of production over this period is estimated to be approximately 9.6 billion cubic feet.

DISCUSSIONS WITH EPA CONCERNING AIR QUALITY REVIEW OF CLEAN COAL PROJECTS

There are discussions continuing between the Department of Energy and EPA. We will keep the Committee informed of EPA's interpretative ruling concerning the air quality review of Clean Coal projects once a decision is made.

CLEAN COAL TECHNOLOGY FULL-TIME-EQUIVALENT SUPPORT

Thirty (30) Full-Time-Equivalent's from the Fossil Energy Research and Development organization were used to support Clean Coal in FY 1989. A similar level of support is anticipated for FY 1990 and FY 1991.

CLEAN COAL TECHNOLOGY FULL TIME EQUIVALENT SALARY COSTS

The 30 Fossil Energy Research and Development personnel assigned to the Clean Coal program are paid from Research and Development funding at a level of about $1.5 million per year, equating to an average salary/budget cost of about $50,000 per Full Time Equivalent.

CLEAN COAL WORKLOAD MEASURES

The following table summerizes the Clean Coal workload measures:

Clean Coal Workload Measures

Workload Indicator	1989	1990	1991
Headquarters			
- Operational Projects	7	16	38
- Projects in Negotiation	18	22	15
Total Projects	25	38	53
- Proposals to Evaluate	48	60	60
- Project NEPA Actions	19	25	35
METC			
- Operational Projects	2	2	9
- Projects in Negotiation	3	8	5
Total Projects	5	10	14
PETC			
- Operational Projects	5	11	29
- Projects in Negotiation	15	17	10
Total Projects	20	28	39
- Project NEPA Actions	15	17	22

In addition to the above indicators, all three CCT organizations require personnel to manage the financial aspects of the program, develop and implement technology transfer and outreach activities, provide supervision, administrative and clerical support, and maintain timely and accurate program information.

FOSSIL ENERGY RESEARCH AND DEVELOPMENT TECHNOLOGY NOT FUNDED IN FY 1991

It is expected that private industry will fund any technology in which they see near term payback. Technical areas in which we would expect industry to continue to fund include: atmospheric fluidized bed combustion, and phosphoric acid fuel cells.

CO-PROCESSING FUNDING COMPARISON

At this time coprocessing is in a developmental stage. The research includes two bench-scale process development units and several smaller scale exploratory technology base activities. In FY 1990, $1,356,000 will be spent on these activities which are budgeted to continue in FY 1991 at a funding level of $1,307,000.

ADDITIONAL COST REQUIRED TO OPERATE THE TWO ENERGY TECHNOLOGY CENTERS ON A REASONABLE BASIS

Assuming the level of support is the Congressionally mandated floors of 715, the Energy Technology Center Program Direction funds needed at a minimum by the Energy Technology Centers, Bartlesville Project Office, and Metairie to operate on some reasonable basis would be as follows:

	Amount ($000)
Salaries and Benefits	$19,199
Travel	1,200
Contract Services	32,000
	$52,399

CLEAN COAL TECHNOLOGIES EXCLUDED FROM CONSIDERATION BY THE CLEAN AIR LEGISLATION

The December 31, 2003, extension for repowering technologies in the Administration's proposed Clean Air Legislation would not exclude any of the Clean Coal repowering technologies that have emerged from the R&D pipelines, e.g., both atmospheric and pressurized fluidized bed combustion, and integrated gasification combined cycle.

ALLOCATION OF CLEAN COAL TECHNOLOGY FTE'S

Currently approved FTE allocations for the Clean Coal Program are as follows:

	CLEAN COAL FTE'S		
	1989	1990	1991
Headquarters	23	23	23
METC	16	16	17
PETC	16	16	20
	55[a/]	55[a/]	60[a/]

[a/] Total FTE's do not include 3 FTEs within the Office of Environment, Safety and Health.

ADDITIONAL COST REQUIRED TO OPERATE THE TWO ETCS ON A REASONABLE BASIS

Assuming the level of support is the Congressionally mandated floors of 715, the ETC Program Direction funds needed at a minimum by the ETCs, BPO, and Metairie to operate on some reasonable basis would be as follows:

	Amount ($000)
Salaries and Benefits	$19,199
Travel	1,200
Contract Services	32,000
	$52,399

QUESTIONS SUBMITTED BY CONGRESSWOMAN LINDY BOGGS

Environmental Concerns

Question: Please describe any programs funded through the Fossil Energy program dealing with the environmental problems attributable to fossil fuel developments? Are any funds requested for this purpose in the FY 91 budget?

Answer: The entire Fossil Energy coal R&D program is generally regarded as being focused on environmental problems since the primary challenge is to meet stringent environmental standards while developing technologies for new applications, higher efficiency, etc.

Environmental activities outside of coal are focused in the Enhanced Oil Recovery program. In FY 1991, the Enhanced Oil Recovery program proposes to initiate a $1.5 million program of environmental research in both heavy and light oil. The proposed research areas include: understanding the environmental impacts of advanced extraction processes, the management of drilling and production wastes, addressing the risks posed to drinking water aquifers by the subsurface movement of injected fluids, research on alternatives to plugging idle wells with cement, and assisting States with data management techniques for risk-based environmental regulatory decision making affecting oil production activities.

The Fossil Energy crosscut for Acid Rain includes programs such as Control Technology and Coal Preparation, Advanced Research and Technology Development, Surface Coal Gasification areas of Systems for Power Production and Systems for Industrial Fuel Gas Production and Clean Coal Technology. The total amounts included in this crosscut are $634.4 million and $489.1 million for FY 1990 and FY 1991 respectively.

In the area of Global Climate change, various Fossil Energy programs are geared toward developing the technologies which have greater energy efficiency, as well as those which reduce N_2O, a potent greenhouse gas.

Wetlands Policy

Question: President Bush has taken a very strong policy stand in support of efforts to preserve the Nation's wetlands. Does the Department have a role in that effort? If so, please describe.

Answer: DOE is a member of the Domestic Policy Council's interagency task force on wetlands, which has been tasked by the President to develop recommendations on wetlands policy. DOE's specific interest is to assure that impacts of energy resources and production are fully considered in the formulation of this policy. It was in that role that DOE participated in the discussions on the Memorandum of Agreement (MOA) between EPA and the Corps of Engineers on wetlands mitigation. DOE supports the revised MOA signed in February.

DOE is also assessing the role of wetlands research as part of a balanced program of environmental research in its oil and gas research programs. A new thrust in environmental research is part of the revised oil and gas programs as described in the forthcoming oil and gas research program implementation plans.

Wetlands Access

Question: The coastal wetlands of Louisiana represent 40% of all the Nation's coastal wetlands. These wetlands harbor extensive mineral resources. Each year over $20 billion in crude petroleum and natural gas production is extracted from wells drilled in wetlands. It is estimated that the dredging of canals for access to oil and gas sites has been responsible for up to half of wetlands loss in south Louisiana. Up to 50 square miles of wetlands are lost in Louisiana each year. Natural resources extraction is responsible for a significant, though not predominant, portion of that loss.

Given that an estimated 80% of Louisiana's remaining petroleum resources are thought to occur beneath our fragile wetlands, that oil and gas exploration and development contributes significantly to the loss of Louisiana's coastal wetlands, and that President Bush has placed such a high priority on wetlands' protection, what is the Department doing to facilitate the development of non-destructive means of access to drilling and production sites located in underdeveloped wetlands areas?

Answer: The Department currently has no research projects specifically addressing access to drilling and production sites in wetlands. The oil and gas research programs have recognized this as one potential area of investigation among a number of environmental research topics. The Office of Fossil Energy is currently considering a broad range of environmental research needs related to oil and gas development and is in the process of defining a balanced program in this area. It is possible that horizontal drilling would allow extraction to proceed with less disruption to the environment, although it would be a state responsibility to get producers to move in that direction. The Office does not currently have enough information on which to base decisions on funding of research projects pertaining to wetlands. DOE's Metairie Site Office (MSO) has been asked to gather information necessary to ascertain research needs related to environmentally acceptable methods of oil and gas exploration and development in wetlands. MSO will consult with the appropriate industry and State organizations to learn their views and priorities.

Wetlands Research

Question: What should the Department's priorities be in addressing the relationship between oil and gas extraction and wetlands loss?

Answer: The Department is committed to the development of national energy resources, including oil and gas, in an environmentally safe manner, and to the Administration's goal of no net loss of wetlands. DOE's priorities lie in ensuring proper balance among the Nation's need for energy security, its economic competitiveness, and the environmental impacts of oil and gas exploration and production.

TUESDAY, MARCH 20, 1990.

ECONOMIC REGULATORY ADMINISTRATION

WITNESSES

MILTON C. LORENZ, CHIEF COUNSEL, OFFICE OF ENFORCEMENT LITIGATION

JERRY F. THOMPSON, DIRECTOR FOR MANAGEMENT AND INFORMATION SYSTEMS

CHANDLER VAN ORMAN, ACTING ADMINISTRATOR FOR THE ECONOMIC REGULATORY ADMINISTRATION

OPENING REMARKS

Mr. ATKINS. The hearing will come to order.

Mr. Chandler van Orman. If you could just, for the record, identify the people who are with you.

Mr. VAN ORMAN. Mr. Chairman, I'd be happy to do that. Sitting on my right is Jay Thompson, who is the Director of the Office of Management and Information Systems. On my left is Milt Lorenz, who is the Chief Counsel of the Office of Enforcement Litigation.

Mr. ATKINS. Do you have a statement you want to make, any opening remarks, or do you want to proceed right to the questions? Your written statement will be made part of the record.

Mr. VAN ORMAN. Mr. Chairman, if you would afford me that privilege, I would tell you that the Economic Regulatory Administration continues to work itself out of business. This is the fifth year in a row in which we have appeared before this committee requesting less money than we did the year before. Since I was here a year ago, we have closed 30 percent of our cases. We have closed one of our two remaining field offices, and we have reduced the staff by 25 percent. Against that background, we have managed to collect nearly half a billion dollars in overcharges.

I'm happy to claim before this committee that in my opinion at least we are the most cost-effective agency in the Government, but that should not be construed as an argument for our continuation. We are headed in the right direction, and we are moving with all deliberate speed, Mr. Chairman.

With that, I'd be happy to respond to your questions.

[The prepared statement of Mr. van Orman follows:]

Statement of Chandler L. van Orman
Acting Administrator, Economic Regulatory Administration
Department of Energy
before the
Committee on Appropriations
Subcommittee on Interior and Related Agencies

Mr. Chairman, members of the Committee, I appreciate this opportunity to provide testimony in support of the funding request for the Economic Regulatory Administration (ERA) for fiscal year 1991. As you know, ERA is charged with the responsibility of completing the regulatory enforcement actions related to crude oil and petroleum product pricing and allocation violations occurring from August 1973 through decontrol in January 1981.

Although President Reagan decontrolled the pricing of oil in January 1981, the statutes creating ERA are still in effect, and the responsibility for enforcing the law on violations occurring during the control period continues. ERA, together with its predecessor organizations, has audited over 100,000 petroleum firms and collected $7.3 billion in oil overcharge recoveries. Currently some 130 cases remain unresolved. It is the intention of this Administration to conclude as expeditiously and responsibly as possible, all remaining oil overcharge cases, either by negotiated settlement or litigation.

Our objectives for FY 1991 are to resolve at least one-third of the remaining cases and collect as much overcharge monies as we can. To meet these goals, the FY 1991 budget request of $11.0 million will fund 107 full-time equivalent (FTE) employees and a $1.2 million litigation support services contract. ERA continues to decrease in size as its caseload declines, and our funding request for FY 1991 reflects this position. The $10.3 million requested for Compliance activities represents a $1.4 million and 21 FTE reduction from ERA's FY 1990 appropriation.

In January of this year ERA conducted a reduction-in-force. Nine positions were affected in the Headquarters office and fifteen in the field offices. The Houston office was reduced to a post-of-duty supervised by Dallas, the only remaining field office.

On February 20, 1990, Secretary of Energy Watkins transferred all of ERA's collection functions relating to the petroleum overcharge funds to the Department's Controller. This was deemed an appropriate action to consolidate DOE's collection activities.

I believe that the Department's funding request will adequately support the fulfillment of all of our assigned responsibilities and at the same time remain fiscally responsible when allocating tax dollars to this effort. I would be happy to answer any questions that the Committee may have.

Mr. ATKINS. Okay. We have a number of technical questions, which we will submit to you. If you could respond to them in writing for the record that would be appreciated.

Mr. VAN ORMAN. We'd be happy to do that.

INSPECTOR GENERAL'S REPORT

Mr. ATKINS. I have a question on the November 1989 Inspector General's report. He raised the issue of the practice of so-called debt settlement. Could you explain that, and explain what the issue is, and what your practices are with debt settlement?

Mr. VAN ORMAN. Mr. Chairman, I would be happy to do that. After we receive a judgment against a company, or execute a consent order with a company, we attempt to collect the amount of money represented in either the judgment or the consent order. In many instances, the companies against whom the judgment is rendered, or with whom the consent order is executed, are in financial extremis. We don't know, during the course of litigation, whether a company possesses enough assets to satisfy a judgment.

We attempt to collect every dollar we can. In many instances, it is necessary for us to go and compromise a debt in order to collect what we can without putting the company into bankruptcy. In those instances, we would renegotiate, if you will, based on the company's ability to pay, take what we can and resolve the case in that manner.

Mr. ATKINS. The IG suggests, and I'm quoting from their report now, "In these nine cases, we found that actions had been taken," and the nine cases are referred to as nine oil overcharge receivables in which a compromise or concession had been made. The receivables the nine had had amounted to an outstanding balance of about $36 million prior to the compromise or concession. It says, "In these nine cases, we found that actions had been taken that were contrary to sound business practices." Could you give me a response?

Mr. VAN ORMAN. Mr. Chairman, the IG's office and my office have both had a running dispute, over the course of the past year, as to whether the provisions of the Federal Debt Collection Act and the Federal Claims Collections Standards apply to our collection of restitutionary funds. In the face of a legal opinion from my shop, in the face of a legal opinion from the General Counsel of the Department, from the Justice Department, and from the Treasury Department, the Inspector General is still not persuaded that these two authorities, one statute and one regulation, do not apply to us.

The statute under which we operate does not proscribe the compromising of claims, and we only do so when it is in the very best interest of the public and the Government.

Mr. ATKINS. The IG suggested that ERA's case tracking system does not provide an adequate audit trail to follow-up on such cases, referring to the cases on which a compromise or concession had been made. Do you have a response to that?

Mr. VAN ORMAN. Yes, sir. I disagree, again, with the Inspector General. We submitted approximately 43 pages of comments disagreeing with almost everything the Inspector General said. I feel that our audit trail is adequate, and that no case was compromised in the absence of justifiable circumstances.

Mr. ATKINS. So you are suggesting that you feel that your audit trail is entirely adequate to allow follow-up on those cases?

Mr. VAN ORMAN. Yes, Mr. Chairman, I do.

COLLECTION POLICY

Mr. ATKINS. The IG suggested in a report again, and let me quote the Inspector General's report of November 1989 entitled "Monitoring and Collecting Oil Overcharge Receivables."

> The largest compromise noted involved a consent order that required the company to pay $5.3 million in 10 annual installment payments of $530,000 each. In June 1987, after three payments had been made, the ERA administrator released the company of any obligation to pay the remaining $3.7 million in exchange for information from the owner that related to an investigation. However, DOE policy does not cite the exchange of information as a basis for reducing a claim.

Could you respond to that?

Mr. VAN ORMAN. Mr. Chairman, I can respond by saying that that did not happen on my watch. The former Administrator, Mr. Staunton, was the one who made that decision, but I am aware that the decision was made. The cases we compromise are done so in accordance not only with Department policy but also Department of Justice policy.

Mr. ATKINS. Were there other things that happened prior to your assumption of responsibility at ERA where there were violations of the policy in terms of compromising claims?

Mr. VAN ORMAN. I'm not aware of any violation of policy. The cases that have been compromised since I became Administrator and, to my knowledge, those that were compromised before, were done so in the minority of cases in an effort to obtain favorable testimony from witnesses. The majority of the cases were compromised simply because it was impossible for the Department to get one penny more from the company.

Many of these companies, after a judgment has been issued or after a consent order has been executed, take bankruptcy. In those instances, we stand in line with everybody else. Many times, we collect pennies on the dollar. In a lot of those cases, we attempt to cash out and get what cash we can rather than waiting in line for some contingent payout. In those instances, the cases would be compromised for the maximum amount of money we think we can get.

Mr. ATKINS. Let me ask on another one. Again, I'm quoting from the same IG's report.

> Another debt that had been referred to the Department of Justice for collection involved a remedial order requiring the company to pay over $2.5 million in principal and interest through the date of the order. This debt was referred on March 24, 1987, for non-payment. Despite the referral, an ERA attorney, and not in the division responsible for collections, negotiated a compromise consent order in June 1988. The consent order obligated the company to pay DOE only $50,000 in four annual installments of $12,500 plus interest. This action was contrary to Department policy which requires that the referring agency refrain from any contact with the debtor after the claim has been referred to Justice.

Mr. VAN ORMAN. Mr. Chairman, all I can do to elucidate you on that point is to tell you that we have an understanding with the Department of Justice, because we do not have the authority to institute collection actions, that when we have a situation in a case that requires that a suit be filed in order to enforce collection, we refer those cases to the Justice Department.

In probably the majority of those cases, the Justice Department will come back to us, because of the expertise that our lawyers had in obtaining the judgment, and we work closely with the Justice attorneys, in addition to working closely with the Assistant United States Attorneys who prosecute these cases. In this case, it is possible that one of our lawyers, in cooperating with the Justice Department, had contact with the debtor and did, in fact, negotiate different terms to the consent order.

Mr. ATKINS. Was that, then, a violation of Departmental policy?

Mr. VAN ORMAN. If there is a policy, in the three years that I've been there, I'm not aware of it.

Mr. ATKINS. So you're not aware of that policy, notwithstanding the IG's——

Mr. LORENZ. Mr. Chairman, if I may, I believe the premise of the conclusion by the Inspector General was, in the first place, that certain policies used by the Department's Controller should be applicable to the Economic Regulatory Administration. As Mr. Van Orman pointed out, at the outset of this discourse, ERA was not in agreement that those particular procedures should be followed.

It is true that the Department's Controller has procedures for handling debts to the Government that the Controller has been historically responsible for. I think the difference was that this agency did not ever contemplate that we were subject to those procedures—until the IG came to their conclusions.

Mr. ATKINS. So your claim is that you were not subject to the procedures that the Department's Controller has for collecting money that is owed to the Government?

Mr. LORENZ. The agency's position was that the Debt Collection Act specifically did not apply. The Inspector General later—I guess I'll use the word "waffled"—and said, "Well, even if it doesn't apply, then those procedures should apply." What precise procedures were set up by the Controller, I'm not aware of. Our work has been done, in a very coordinated fashion, with the Department of Justice.

As Mr. Van Orman alluded to, usually we wind up doing virtually all of the work on those enforcement cases that are brought. It may well be that at the end point, in fact, our attorney dealt directly with the debtor in the case. That is not unusual, especially where the Department of Justice has given us the primary litigation authority.

TRANSFER OF COLLECTION FUNCTION

Mr. ATKINS. We now have a situation where, with regard to the collection of receivables, the Controller's Office is taking over responsibility. Is that correct?

Mr. LORENZ. That is correct.

Mr. VAN ORMAN. That is correct.

Mr. ATKINS. Is that fully implemented now?

Mr. LORENZ. Yes.

Mr. ATKINS. Now is the Controller obeying the rules and regulations that the Controller has established, or are you maintaining that the Controller doesn't have responsibility to——

Mr. LORENZ. We presume they are complying with their own procedures, but we have no personal knowledge. This is very recent, I think, February 20.

Mr. ATKINS. But since February 20, all collection of receivables is the responsibility of the Controller's office?

Mr. LORENZ. Correct.

Mr. VAN ORMAN. Mr. Chairman, that is true, but there are two kinds of receivables. There are debts to the Government, and there are restitutionary funds resulting from overcharges. The Federal Debt Collection Act and the Federal Claims Collection Standards apply to debts owed to the Government. Restitutionary monies that we collect are not debts; they are restitutionary funds. Consequently, the Controller, while now coordinating the collection of all monies owed to the Department, is collecting two separate types. One is debts, and the second is restitutionary funds. The procedures of the statute and the regulation I referred to apply to the collection of debts. They do not apply to the collection of restitutionary funds, so I assume——

Mr. ATKINS. According to your interpretation.

Mr. VAN ORMAN. According to the General Counsel's opinion and to a Supreme Court decision also.

Mr. ATKINS. But the IG takes exception to that?

Mr. VAN ORMAN. Not currently. It did in the draft report, and to use Mr. Lorenz's word, they have waffled significantly since then.

Mr. ATKINS. Well, waffle is a word that is used frequently in this business and in your business. I'm not sure it has the highest definition. Are you telling me that the IG has rescinded their view and disavowed their view that in the collection of so-called restitutions that the Department has a responsibility for following their policy for collection of receivables?

Mr. LORENZ. Well, the Inspector General first concluded that the Debt Collection Act procedures should apply. Secondly, after there was some exception taken to that conclusion, they revised their conclusion to that of "well, even if it does not apply, the same kinds of procedures should have been used." Therefore, it is easy to make the conclusory statement that we did not follow those procedures. I think Mr. Van Orman will acknowledge that we did not follow their procedures. It would be silly for us to claim otherwise.

Mr. ATKINS. My question is what the IG's position is at this point.

Mr. LORENZ. Their position is that we should have followed the procedures of the Controller's office.

Mr. ATKINS. Notwithstanding your suggestion that they waffled, they still maintained the same position that they had originally.

Mr. LORENZ. Well, they didn't maintain the same position, which is that by law the Debt Collection Act and the Federal Claims Act applied.

Mr. ATKINS. But they did maintain that they did apply——

Mr. LORENZ. No, sir. They backed off of the conclusion that the statutes applied. They did revise that. They do not any longer state that those two Acts apply. They are, by analogy, however, suggesting and concluding that the same procedures should have been used.

DELINQUENT ACCOUNTS

Mr. ATKINS. Can you tell me the extent of delinquent accounts that are still in the DOE's purview?

Mr. VAN ORMAN. I think my friend, Mr. Thompson, would be happy to answer that question.

Mr. THOMPSON. As of January 1, there were around seven or eight cases that were in what we call a delinquent status. When we timely transferred the entire function to the Controller's Office in February, it was probably up to 13 or 14.

Mr. ATKINS. Thirteen or 14.

Mr. THOMPSON. That's a very low number of delinquent cases, in my opinion, considering there were something like 100,000 cases that were audited over the period of years and taken collection on. That is a pretty minimal number.

Mr. ATKINS. Do you expect that number to continue to grow significantly?

Mr. THOMPSON. I wouldn't expect it to grow significantly. You never know whether people that are paying are going to pay tomorrow or not. That's a function of how many delinquencies we have. I would not expect it to grow significantly. I would like to see it decline further.

COORDINATION WITH THE DEPARTMENT OF JUSTICE

Mr. ATKINS. Can you tell me the extent of follow-up with the Department of Justice?

Mr. VAN ORMAN. Mr. Chairman, I can answer that question. Approximately a year, or maybe more than a year ago, I instituted a monthly follow-up with the Department of Justice in an attempt to learn the status of the cases we had recommended for collection to Justice. The Department of Justice responded not as frequently as I inquired, and approximately two to three months ago, the last communication from Justice was, "Please don't send us a monthly inquiry. We can't get to it. We can't get to the ones we've got. We'll let you know when we can."

These cases are typically unattractive to Assistant U.S. Attorneys. They involve, many times, companies who are almost judgment-proof. They wind up on the bottom of the pile. When cases are filed against these companies, it is really the exception rather than the rule. We hear from Justice when it suits Justice's convenience to tell us what the status of these cases is.

TRANSFER OF PERSONNEL

Mr. ATKINS. Can you tell me, since you're transferring functions for the collection process over to the Controller, are you transferring personnel over to the Controller as well?

Mr. VAN ORMAN. Mr. Chairman, we have transferred three FTE's, plus we have detailed another one of our personnel for as long as it takes to get the Controller's Office up to speed.

CITIES SERVICE CASE

Mr. **Atkins**. Can you tell us the status of the Cities Service case?

Mr. **Van Orman**. Mr. Chairman, we had the proposed consent order which we negotiated a year ago in November. We held the public hearing to gauge the public interest in this. It was determined approximately a month ago that the consent order should be revisited. We informed Cities Service that we were reopening negotiations. In fact, we have a meeting scheduled tomorrow with the principals of Occidental Petroleum, so we are back in the negotiating stage.

Mr. **Atkins**. Thank you. We have other questions that we'll submit for the record.

Mr. **Van Orman**. Thank you very much, Mr. Chairman.

Mr. **Atkins**. Thank you.

[Questions and answers for the record follow:]

ADDITIONAL COMMITTEE QUESTIONS

Compliance Cases

Question: How many compliance cases remain open?

Answer: There are approximately 130 cases open at this time.

Question: How does that compare to the same time last year?

Answer: Last year at this time there were approximately 188 cases.

Question: How many cases were completed in FY 1989?

Answer: Approximately 85 cases were resolved during FY 89.

Question: What was the dollar value of the cases completed?

Answer: The dollar value of the cases closed during the past year was approximately $355 million. In addition, the value of three partial resolutions was $47 million.

Question: Please provide a list of the major cases and amounts for the record.

Answer: There were 5 major cases resolved in FY 1989 with a total recovery value of $305.2 million. They are as follows:

Case	Recovery Value
Apex/Clark	$15 million
Marathon	$18.9 million
Howell/Quintana Corp.	$23.2 million
Tesoro	$48.5 million
Getty Oil	$199.6 million

In addition, Chevron paid $42 million in partial resolution of the pending MDL-378 action in which it is involved.

Question: How many do you expect to complete in FY 1990?

Answer: The 143 cases at the beginning of FY 1990 are expected to be reduced in FY 1990 by approximately 30% to 100 - 110.

Question: How many do you expect to complete in FY 1991?

Answer: We expect that the estimated number of cases at the beginning of FY 1991, 100 - 110, will be reduced during the fiscal year by 30%, to 70 - 75.

Question: What is the nature of the remaining cases (for example, bankruptcies, judicial litigation, etc.)?

Answer: The remaining cases in administrative litigation involve Proposed Remedial Order proceedings before the Office of Hearings and Appeals and OHA Remedial Order appeal proceedings before the Federal Energy Regulatory Commission in the following subject matter areas: cases against (1) crude oil producers for violations of ceiling prices rules; (2) crude oil resellers for "layering" and price overcharges, and miscertification; (3) small refiners for violations of Entitlements Program regulations; (4) refined product resellers/retailers for price overcharges; (5) one major refiner for unlawful tie-in crude oil resale transactions. The remaining judicial cases principally involve the following areas: (1) In Re: The Department of Energy Stripper Well Exemption Litigation, MDL No. 378 (D. Kan.) and the disputed claims arising out of the litigation; (2) judicial appeals from Subpart V determinations by the Office of Hearings and Appeals; (3) judicial review of remedial orders of the Federal Energy Regulatory Commission; (4) bankruptcy proceedings; (5) declaratory judgment actions in which DOE must defend an agency action or decision; and (6) direct enforcement actions against persons or firms alleged to have violated the Mandatory Petroleum Price and Allocation regulations or orders issued pursuant thereto.

Of the 130 remaining cases, 52 are before OHA or FERC, and 78 cases are in federal court; 44 of the 78 court cases are bankruptcy proceedings.

Question: What is the process involved in a case moving from administrative litigation to judicial litigation?

Answer: Cases to enforce the mandatory petroleum price and allocation regulations move from administrative litigation to judicial litigation in either of two ways: (1) a party found by a Remedial Order issued by the DOE's Office of Hearings and Appeals (OHA) to have violated the regulations seeks judicial review of a Remedial Order issued by the Federal Energy Regulatory Commission (FERC) affirming the OHA Remedial Order; or (2) the recipient of an OHA Remedial Order fails to appeal the Order to FERC, and the DOE requests the Justice Department to initiate judicial litigation to collect the restitutionary sum ordered by the Remedial Order.

Question: Do all cases go through administrative litigation first? If not, on what basis is it bypassed?

Answer: Although there have been past occasions (e.g. Exxon) where the ERA sought to by-pass the administrative litigation process, it is ERA's current policy to utilize the administrative process in advance of judicial litigation. All enforcement cases initiated by ERA are commenced with administrative litigation before the Office of Hearings and Appeals. If DOE is sued by a private party, however, or the firm files for protection in the bankruptcy courts, there may not be completed administrative litigation.

Collections

Question: Last year (page 33) you provided a list of delinquent cases. Please update that list for the record.

Answer: The following table indicates the status of both cases transferred to the DOJ and the 6 cases still within the ERA, as of January 1, 1990:

COMPANY	AMOUNT DUE	COMMENT
AD ENERGY, INC.	5,715,351	DOJ suit authorized 01/19/90
ALCATRAZ MOBIL SERVICE	17,667	Referred to DOJ 08/01/84
ALLEN'S UNION	2,956	DOJ suit authorized 05/07/86
BARKETT OIL COMPANY	5,249,097	DOJ suit authorized 09/15/88
BEACON HILL GULF	125,696	DOJ suit authorized 12/05/89
BRAZORIA ENERGY, INC.	17,272,684	Referred to DOJ 03/30/88
BRIDEWELL	99,473	DOJ suit authorized 06/12/86
BRIO PETROLEUM	6,724,462	DOJ suit authorized 06/10/88
BUXTON, F.M.	183,437	DOJ suit authorized 12/11/89
CHARLIE'S EXXON SERVICE	14,400	Referred to DOJ 08/01/84
CITRONELLE MOBILE GATHERING	25,524,901	DOJ collecting on judgment
CONE, J. R.	3,891,238	Referred to DOJ 07/23/87
CORPUS CHRISTI MANAGEMENT	1,888,351	DOE collecting on judgment
CPI CRUDE, INC.	26,593,672	DOE collecting on judgment
CRESCENT REF/PETROLEUM FUEL	66,419	DOJ suit authorized 01/30/86
DON E. PRATT OIL OPERATIONS	1,156,247	Referred to DOJ 08/09/88
EAST 14th AUTO CLINIC	9,430	DOJ collecting on judgment
ELDON SPENCER OILS, INC.	374,114	DOJ suit authorized 09/27/88
ELWOOD CHEVRON SERVICE	27,795	DOJ suit authorized 01/17/85
ESTES ENGINEERING	1,065,943	DOJ collecting on judgment
GENERAL ATLANTIC PETROLEUM	1,847,251	DOJ collecting on judgment
GENERAL EQUITIES, INC.	76,883	Referred to DOJ 02/28/90
GORMANS MOBIL	192,384	Referred to DOJ 10/12/88
GRAY TRUCKING CO.	67,537	DOJ collecting on judgment
GULFPORT OIL CO. & J. HARRIGAN	2,096,137	Documenting write-off, no assets
HARRIS, JAMES W.	97,683	Referred to DOJ 10/25/88
HIDECA PETRO CORP	46,105,890	DOJ suit authorized 06/09/89
HOUMA OIL COMPANY	66,910	DOJ suit authorized 09/05/89
HYDROCARBONS, LTD.	1,854,319	Referred to DOJ 03/13/87
INTERCOASTAL OPERATING	3,830,001	Referred to DOJ 06/27/89
ISTHMUS TRADING CORP	10,710,002	Referred to DOJ 09/01/88
JACK HOLLAND AND SON	100,667,367	Referred to DOJ 06/30/89
JAMISON'S SUNOCO	25,764	DOJ suit authorized 09/05/89
JAY OIL COMPANY	68,758	DOJ collecting on judgment
JOHN R. ADAMS	53,090	DOJ suit authorized 05/15/89
LAWRENCE L P GAS	92,480	DOJ suit authorized 04/26/89
LEA EXPLORATION	1,027,369	DOJ collecting on judgment
LOBO OIL CORPORATION	659,379	DOJ collecting on judgment
LOTUS PETROLEUM	20,416,534	DOJ suit authorized 12/18/89
LOUISIANA CRUDE OIL/GAS CO.	991,536	Referred to DOJ 05/20/88
MARINAS OF THE FUTURE, INC.	22,283	DOJ suit authorized 12/05/88
MAXWELL OIL CO.	7,702	DOJ suit authorized 09/05/85
METROPOLITAN PETROLEUM	583,771	DOJ filed suit 04/19/89
MIRALOMA SHELL	9,109	DOJ suit authorized 01/17/85
MOCKABEE GAS & FUEL COMPANY	110,708	DOJ filed suit 02/12/90
NATIONAL HYDROCARBON	21,527,108	DOJ suit authorized 07/26/89
NORCO OIL COMPANY	344,425	DOJ collecting on judgment
OTIS AINSWORTH	1,399,225	DOJ suit authorized 09/15/89

COMPANY	AMOUNT DUE	COMMENT
PAUL L. HEATLEY COMPANY	14,010,013	DOJ suit authorized 11/21/88
PETE ALIJIAN CHEVRON	7,311	Referred to DOJ 09/20/88
PETROLEUM CARRIER CO	4,472,560	DOJ filed suit 03/01/89
PETROLEUM DELIVERY SERVICE,INC	1,018,066	DOJ suit authorized 09/14/88
PETROTECH TRADING	50,706,096	Referred to DOJ 10/03/88
PLAZA ARCO/SHELTER RIDGE ARCO	36,069	Referred to DOJ 10/17/88
POWER MANAGEMENT, INC.	559,817	DOJ collecting on judgment
PRIME RESOURCES CORP.	19,045,198	DOJ collecting on judgment
R. P. TRADING CO.	6,042,461	Refer to DOJ
RALPH MITCHELL'S HILLTOP	15,465	Referred to DOJ 08/01/84
RAMCO OIL COMPANY, INC.	312,358	DOJ suit authorized 04/13/89
RANCHERS OIL COMPANY	37,510	DOJ suit authorized 07/08/83
ROAD OIL SALES/JOHN HOLLAND JR	1,293,049	Referred to DOJ 06/30/89
SABINE REFINING & TRADING	11,586,100	DOJ collecting on judgment
SALEM VENTURES, INC.	565,704	DOJ suit authorized 12/20/89
SCOTT & AGAJANIAN	334,630	DOJ suit authorized 05/11/87
SCOTT OIL COMPANY	807,497	DOJ suit authorized 05/11/87
SHERER OIL COMPANY	1,297,253	DOJ negotiating with firm
SOUTHWEST PETROCHEM	43,327,088	Referred to DOJ 12/14/88
STARK'S SHELL SERVICE	45,208	DOE collecting on judgment
SUNSET BLVD. CAR WASH	44,743	DOJ suit authorized 01/17/85
T & M PETROLEUM, INC.	6,200,966	Referred to DOJ 11/17/89
TAMPIMEX, INC.	12,834,711	Documenting write-off, no assets
THETIS ENERGY CORP.	386,170	DOJ suit authorized 02/15/89
TOMMY OIL CO.	639,310	DOJ filed suit 10/20/88
TRANSCO TRADING CO.	71,400,868	Referred to DOJ 05/10/88
TUGALO GAS COMPANY	207,979	DOJ suit authorized 12/11/89
UNITED INDEPENDENT	1,396,085	DOJ suit authorized 10/01/88
WALL, EARL E.	73,001	DOJ suit authorized 01/09/90
WILLIAM SCOTT	415,547	DOJ suit authorized 05/11/87
****TOTAL****	560,073,771	

Question: What is the value of collections made in FY 1989 from delinquent cases?

Answer: During FY 1989, collections from delinquent cases totalled $2.4 million.

Question: With regard to collection of receivables, the Controller's Office is taking over responsibility. Please explain just what functions will now belong to the Controller and what actions in the collection process will still be the responsibility of ERA.

Answer: All functions associated with the collection of receivables have been transferred to the Controller's Office. The ERA will have the responsibility of continually monitoring ERA active litigation cases and transferring all cases with final judgments or orders to the Controller's Office for collection. The ERA will also monitor cases for final payments in order to petition the Office of Hearings and Appeals to commence Subpart V proceedings.

Question: Will personnel be transferred to the Controller? If so, how many?

Answer: Three FTE's (one encumbered position) will be transferred to the Controller.

Question: How much will that reduce the FY 1991 request?

Answer: ERA's FY 1991 request would be reduced by 3 FTE's and $242,000. This will be reprogrammed to the Controller in FY 1991 if the funding remains in ERA's budget.

Question: What is the extent of delinquent accounts still in DOE's purview, given that many are already referred to the Department of Justice for collection?

Answer: A total of 6 delinquent accounts were in DOE's purview as of December 31, 1989. This compares to 16 such cases a year ago.

Question: What is the extent of follow-up with the Department of Justice?

Answer: Approximately two years ago, the ERA Administrator met with DOJ officials to improve communication and monitoring of cases at the DOJ. For over a year, the ERA has requested monthly updates of the status of cases referred to DOJ. DOJ has responded to these requests at approximately 4-month intervals.

Question: Who will be responsible for this follow-up?

Answer: The Controller's Office will be responsible for follow-up with the Department of Justice.

Question: Will this still be ERA's responsibility?

Answer: No, it will be the responsibility of the Controller.

Question: What is the extent of this practice?

Answer: For over a year, the ERA has requested monthly status reports from the DOJ. As the collection responsibility has been transferred to the Controller's Office, the ERA assumes that the Controller will continue to monitor the referred cases on a regular basis.

Stripper Well Cases

Question: Please update the information provided in last year's hearing (pages 20-31) on stripper well status.

Answer: The following list of cases is similar to that provided last year:

STRIPPER WELL LITIGATION DEFICIENCY CASES

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
Aminoil USA, Inc.	$4,487,854.73 (10/15/86)	Review of secondary records for 55 properties completed. Review raised questions on 6 of those properties, and further analysis required	Unknown	Unknown
Anadarko Production Co.	$19,545,886.73 (5/30/86)	(1) Settlement proposed being reviewed	(1) Deducted taxes	(1) $1,506,084 plus interest for taxes
George Anderman & Donald Kirby (interest owners in Texaco operated properties)	$183,130.86 (5/30/86)	(1) Liability resolved by M.D.L. 378 settlement with Texaco (2) Case has been dismissed	N/A	N/A

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
ARCO	$92,808,013.00 (5/30/86)	(1) DOE has completed deficiency calculation (2) DOE agreed with firm on settlement, which is under review by Dept. of Justice.	(1) Deducted taxes (2) Admits it "inadvertently" failed to escrow $28,136.20 on one property (3) Delays in making some deposits into escrow	$5.3 million
Jimmie Austin d/b/a Austin Drilling	None	Case dismissed; no deficiency	N/A	N/A
Braden-Zenith	$1,433,871.00 (5/30/86)	Case under Review	(1) Escrow does not include stripper overcharges occurring for five years before injunction received (2) Deducted taxes	$2,479,506.16 excluding interest from 4/87

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
Champlin	$7,596,216.41 (5/30/86)	(1) Auditors completed review of information provided, and ERA sent firm a demand letter on Jan. 25, 1988 (2) Deficiencies have been discussed with firm. Firm has obtained and provided most of the additional information requested by DOE, and process will be completed 4/15/90.	(1) Insufficient escrow payments for 2 properties (2) Failed to escrow funds for certain interest owners and in-kind oil (3) Delays in making some escrow deposits	$4,206,669 including interest through 12/31/87

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
Conoco	$46,781,670 (3/1/90	(1) Overcharge calculations have been reviewed with firm, it has provided additional data to support a recalculation, and it has gathered data on oil taken in-kind (2) We are reviewing data provided by firm and formulating deficiency calculation.	(1) Deducted taxes (2) Only escrowed its interest on certain properties	$3.8 million plus interest
Crystal	$1,222,421.63	Case settled for $236,214 and dismissed	N/A	N/A
Robert C. Davis	None	Case settled for $198,637 and dismissed	N/A	N/A
Energy Reserves Group, Inc.	$9,281,947.43 (3/1/90)	After DOE recomputed final deficiency amount, firm paid $210,122 in settlement. Case dismissed	N/A	N/A

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
Exxon	$24,605,920.59 (5/30/86) plus deposit of over $108 million (10/86)	Exxon agreed to pay $108 million; case settled and dismissed	N/A	N/A
Farmers Crude	$2,214,791.05 (5/86)	Case settled for $357,212 and dismissed.	N/A	N/A
Gulf Oil Corp.	$211,733,939 (3/1/90)	DOE filed with Court Motion for Summary Judgment, firm filed Counter Motion on legal issues and oral argument is tentatively scheduled for May 30, 1990.	(1) Interest on late deposits (2) Failed to deposit portion attributable to other interest owners prior to 11/78 (3) Severance taxes	Over $162 million, including interest through 12/89
Hunt Oil Co.	$3,964,170.80 (5/30/86)	Case settled for $54,859 and dismissed	N/A	N/A
I.U. International Oil & Gas Co.	None	Case settled for $2,438,940 and dismissed	N/A	N/A

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
Estate of Killingsworth	$3,682,204.48	Case dismissed; no additional violations	N/A	N/A
Kirkwood Oil & Gas Co.	None	Case settled for $53,966 and will be dismissed	N/A	N/A
Patricia Leonard, et al. (interest owners)	None	No deficiency; case dismissed	N/A	N/A
Will I. Lewis Enterprise Inc.	None	No deficiency; case dismissed	N/A	N/A
Marathon Oil Co.	$43,223,969.91 (5/86)	Case settled for $18,889,174 and dismissed	N/A	N/A

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
Mobil	$67,794,977 (3/1/90)	(1) On August 25, 1989, Court granted DOE's Motion for Summary Judgment for $10.2 million (2) Firm's motion for reconsideration is ripe for decision by the court.	(1) Deducted taxes (2) Interest on late despoits	$8.5 million through 12/89
Muskegon Development	$10,840,572.82	Case settled for $54,744.26 and dismissed	N/A	N/A
Petroleum Corp. of Texas	$10,008,847.70	Case settled for $853,675 and dismissed	N/A	N/A
Petroleum Mgmt., Inc.	None	No deficiency - case dismissed	N/A	N/A
Pioneer Operation Co., Inc.	None	Judgment for $202,436, plus interest, obtained against firm.	N/A	N/A

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
Ruthven Inc.	None	Judgment for $333,206, plus interest, obtained against firm.	N/A	N/A
Sante Fe	$192,196.99	Motion for Summary Judgment against firm filed February 1990	(1) Failure to deposit portion attributable to other interest owner (2) Interest on late payment	$486,766, plus interest from 3/1/90
Sierra Petroleum Co., Inc.	$421,339.50 (8/86)(Treasury-escrow account, "earmarked to be distributed" pursuant to court order)	Case dismissed; no deficiency	N/A	N/A
Sklar-Phillips	$1,068,110.51 (5/30/86)	Demand letter being prepared	Failure to deposit full amount of overcharges	$935,000, plus interest accruing after 3/31/90
Sohio	$236,900.31	Case settled and dismissed	N/A	N/A

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
Stelbar	$1,212,665.73	Firm paid over $36,000 to settle, and case dismissed	N/A	N/A
Suburban Propane Gas Corp.	$5,946,172.43 (5/30/86)	Judgment entered for DOE. Firm paid deficiency into escrow	N/A	N/A
Sun	$222,406,076.94 (5/30/86)	On March 14, 1990, DOE filed Motion for Summary Judgment for $30.8 million. DOE also has filed motion to sever firm's third party complaint. Sun's is expected to respond to DOE's Motions on 5/1/90.	(1) Deducted taxes (2) Failed to escrow overcharges for oil taken-in-kind (3) Interest on late deposits (4) Undeposited overcharges	Approximately $30.8 million plus interest accuring after 3/31/90.
Texaco	$213,195,302.68 (3/1/90) (5/30/86)	Texaco agreed to settle and paid $52 million into MDL escrow account. Case dismissed	N/A	N/A

Plaintiff	Amount Paid to Escrow	Status	Types of Known Deficiencies	Current Estimate of Deficiencies
Wood Oil Co.	None	Wood has submitted data alleged to demonstrate payments in complaince with consent order. Information under review, additional documentation sought.	Overcharges covered by consent order which Wood has not complied with	$2.1 million
Don Wallace	None	Case dismissed; no deficiency	N/A	N/A

Question: What additional amounts have collected, and from whom, since December 1988?

Answer: The following table shows the amounts of Stripper Well deficiency funds collected, and from whom, since December 1988:

MDL STRIPPER WELL DEFICIENCY FUNDS
COLLECTED FROM JANUARY 1, 1989
THROUGH MARCH 22, 1990

DATE	FIRM	AMOUNT
02-28-89	Mobil Oil Corp.	$ 2,359,906.00
04-18-89	Marathon	18,889,174.00
04-19-89	Muskegon	54,744.26
05-05-89	Crystal Oil Co.	236,214.00
05-19-89	Fairway Oil Co.	8,532.46
06-07-89	I.U. International	2,438,940.00
06-30-89	Hunt Oil Co.	54,859.00
07-24-89	Farmers Crude Prod.	357,212.00
07-31-89	BHP Houston	210,122.00
08-04-89	CONOCO	2,496,524.00
09-29-89	Chevron	42,353,435.00
10-17-89	Mobil Oil Corp.	699,184.17
11-03-89	Mobil Oil Corp.	599,184.17
11-21-89	Chevron	3,107,036.00
12-07-89	Mobil Oil Corp.	599,184.17
12-20-89	Mobil Oil Corp.	599,776.20
12-26-89	Robert E. Davis	16,553.08
02-05-90	Santa Fe Energy	26,028.36
03-14-90	Kirkwood Oil	53,966.00
03-19-90	Mobil Oil Corp.	88,964.57

Major Open Cases

Question: What is the status of the Cities Service case? Please explain the nature of the case, and where it stands in the litigation process.

Answer: The case against Cities Service Company is currently stayed before the Federal Energy Regulatory Commission (FERC) pending completion of procedures on a proposed Consent Order executed on January 31, 1989, by DOE and Occidental Petroleum Corporation, Cities' parent company. The proposed settlement contemplates the payment to DOE of $205.08 million, over eight years. At present, DOE is attempting to renegotiate the terms of the proposed Consent Order.

In the administrative enforcement proceeding against Cities, the DOE charges that in 91 tie-in crude oil resale transactions between October 1979 and January 1981, Cities sold 13 million barrels of price-controlled crude oil to several resellers, unlawfully tied to Cities' purchase of equivalent volumes of exempt-certified oil from those resellers at discounts of 50% or more below market prices. On September 30, 1988, the DOE's Office of Hearings and Appeals issued a Remedial Order affirming ERA's charges that the below-market discounts Cities received constituted the charging of unlawful prices in sales of the firm's price-controlled oil; directing Cities to make restitution of $263.8 million, plus interest, and remanding to ERA for further enforcement action the issue of whether in the subject crude oil transactions Cities violated the DOE's Entitlements Program regulations. Cities appealed the Remedial Order to FERC, which, as noted above, stayed the appeal proceeding pending the completion of procedures on the proposed Consent Order.

Question: Are there other major open cases? If so, please briefly describe them.

Answer: The largest of the remaining cases are described below:

a. Cities - an OHA Remedial Order found that the firm's tie-in crude oil resale activities constituted pricing violations, and orders refunds of $264 million plus interest. A proposed settlement of the case is pending, and Cities' appeal to FERC from the Remedial Order is currently stayed.

b. Gulf - This MDL-378 case is pending in federal district court, where the government is seeking $162 million (including interest) based on Gulf's failure to timely deposit into the court escrow all crude oil overcharges arising out of the company's counting of injection wells as producing wells.

c. Tomlinson - A PRO stayed by the bankruptcy court, alleges $74 million plus interest for layering violations in resales of crude oil. The DOE has filed alternative proof of claims in the bankruptcy proceedings of the parent and the subsidiary for $129 million, and $131 million, respectively, including interest through thedate the respective bankruptcy petitions were filed.

d. Texas Energy Reserve - A PRO pending decision at OHA seeks refunds of $112 million plus interest for the firm's layering in crude oil resales.

e. Salomon - a PRO seeking $107 million of refunds (plus interest) for layering and pricing overcharges on resales of crude oil is pending before the Department's Office of Hearings and Appeals.

f. LaJet, et al - DOE brought three different cases against these related firms. Two of the cases, involving charges that the firms used sham processing agreements to circumvent entitlements obligations, are final Remedial Orders directing refunds of $5 million plus interest. A third case, pending at OHA, seeks $91 million plus interest based on allegations that the firm engaged in sham crude oil "recertification" transactions to evade its entitlements obligations. DOE's claim in bankruptcy is for $255 million, including interest through the date the petition was filed.

g. Merit Petroleum - There are two cases pending against this firm, one for $28 million plus interest and the other for $48 million plus interest. The first case, which is on appeal at FERC, involves charges of layering and pricing violations on the firm's resales of crude oil. A proposed Decision and Order awaits action by the Commission. The second case, which is a PRO pending before OHA, charges that the firm layered in certain other of its crude oil resales.

h. Houston Oil & Refining - This case, involving crude oil layering issues and refunds of $58 million plus interest, is pending appeal at FERC. A proposed Decision & Order awaits action by the Commission.

i. Revere Petroleum - A PRO seeking $51 million plus interest for crude oil resale layering violations is pending at OHA.

Staffing

Question: The budget justification (page 503) show 117 personnel for FY 1990 even though the appropriation provided funding for 129 people. Please explain the difference.

Answer: In January 1990, the Department re-allocated its overall FTE level among the various DOE organizations. Because of the upcoming reduction-in-force and declining workload, it was determined that ERA did not need the 129 FTE's originally allocated.

Question: A November 6, 1989 letter to Congress discussed a planned Reduction-in-Force. Did this reduction take place?

Answer: Yes. Effective January 26, 1990, the reduction-in-force abolished nine headquarters and fifteen field office positions.

Question: How is it related to the reduced number for 1990 in the budget justifications?

Answer: The reduction-in-force of twenty four positions was factored in the Department's decision to reduce ERA's FY 1990 FTE level from 129 to 117.

Question: Of the people remaining in ERA, where are they located?

Answer: The remaining ERA employees are located in our headquarter's office in Washington, D.C., and in our one remaining field office in Dallas, Texas. Three of our Dallas employees have their post-of-duty located in Houston.

Question: When do you expect to close your two field offices?

Answer: As stated in answer 27, ERA closed the Houston field office, as such, with the January 26 RIF. The three auditors in Houston report to the Dallas field office. There are now a total of 12 employees in the Dallas office. The ERA has no immediate plans to close either the Houston post-of-duty or the Dallas field office. While the ERA case load is certainly winding down, sufficient historical, technical, and legal expertise is needed to complete the remaining cases. To be sure, as the ERA has demonstrated by closing over 130 field offices, the remaining field office will be closed when its resources are no longer required.

Legal Fees

Question: Please review for the Committee what lawyer fees are allowed on the major oil overcharge cases. GAO recommends in a March, 1989 report that DOE provide clear policy guidance to the States on the use of stripper well and Diamond Shamrock funds for Exxon legal expenses. You say in a November, 1989 response that your clear statement of policy is that stripper well recoveries should not be used to pay Exxon legal expenses. Are stripper well funds being used for that purpose?

Answer: Only three matters have dealt directly with the question of attorneys' fees. The Exxon case provided that all the refunds should be paid to the States in proportion to their consumption of petroleum products during the period of controls. In that case, Judge Flannery ordered that none of the refunds could be used for administrative costs, including attorneys' fees, but he did not proscribe the use of funds from other cases for payment of administrative or legal expenses incurred on the Exxon case. In the Diamond Shamrock case, the court order specifically provided that the states could use their portion of the refund for administrative costs, including attorneys' fees, incurred in other oil overcharge cases (not restricted to Diamond Shamrock). In the Stripper Well case, the court-approved settlement provided expressly for attorneys' fees to be paid out of the specially created escrow funds to counsel for some of the private claimant groups which participated in the distribution of refunds. With respect to refunds to the States, the agreement provided that each State could expend for administrative costs, including attorneys' fees, up to five percent of the refunds that it received. There was no express provision in the settlement agreement limiting the use of the States' refunds to costs incurred in the Stripper Well case itself, or prohibiting their use for costs incurred in Exxon or any other oil overcharge case.

The provisions of the 1989 Stripper Well Agreement, to which DOE and the States are parties, govern the use of refunds obtained in all subsequent resolutions involving crude oil overcharges. Therefore, up to five percent of any Stripper Well funds received may be used by the States to pay attorneys' fees or other administrative expenses incurred in connection with any case covered by the Agreement. This conclusion should not, however, be confused with the question of whether _Stripper Well_ funds should be used for attorneys' fees on the _Exxon_ case.

The Department expressed its view on that question in its November 18, 1986 communication to the various state governors, but as the GAO was advised in November of 1989, the legal enforceability of the DOE's policy may be problematic given the terms of the _Stripper Well_ agreement itself.

According to GAO's 1989 report, only eleven states acknowledged using stripper well funds to pay _Exxon_ legal expenses. Of the seven states reviewed in more detail by GAO, with total legal fees of about $7.7 million, three apparently paid in the aggregate $51,524 for _Exxon_ legal expenses. Reports the States have provided to the Department regarding their disbursements of _Stripper Well_ funds show that as of June 30, 1989, the States have received _Stripper Well_ refunds in the amount of $1,125,379,913, and have expended for administrative costs in all eligible programs a total of $9,904,689, including $6,581,236 for attorneys' fees. The reports reflect the payees and the amounts of the payments, but they are not broken down in accordance with the cases in which the costs were incurred. Accordingly, while there has been some use of _Stripper Well_ funds for _Exxon_ legal expenses, it appears to be insignificant in relation to the entire amount of stripper well funds received by the states, or even to the five percent ceiling on administrative expenses.

Question: If so, what recourse do you have to stop such usage?

Answer: As noted by the GAO in its report on the matter, it was "unable to find" support in either the _Exxon_, _Stripper Well_, or _Diamond Shamrock_ cases for a prohibition on states using _Stripper Well_ or _Diamond Shamrock_ funds for _Exxon_ legal expenses". The Department has informed the States of its policy view, however, and their compliance must be based on comity and cooperation rather than litigation.

QUESTIONS SUBMITTED BY CONGRESSMAN RALPH REGULA

Compliance Cases

Question: You stated that you have 140 cases unresolved with a projected 100-110 of these slated for litigation.

What is the likelihood that you can resolve these cases and meet your goal of transferring programs to other DOE organizations in 2 years?

Answer: The Economic Regulatory Administration currently has approximately 130 cases in litigation. Generally, the cases are resolved either through settlement or the completion of the litigation itself. We project that the number of remaining cases at the beginning of FY 1991 will be reduced to 100 to 110, and that the number of cases remaining at the beginning of FY 1992 will be reduced to 70-75. We further project that some time during FY 1992, approximately two years from now, the number of pending cases will be in the range of 40 to 60. With such a relatively small number of cases, most at or very near the end stages of litigation, that would be a reasonable time to transfer the Agency's functions (which are virtually all litigation-related) to another appropriate DOE element. Although all of the cases will not have been completed by then, the management of the remaining effort will be more effectively carried out by an organization having greater flexibility to staff the sporadic workload of the last cases.

POTENTIAL FOR OIL PRICE INCREASES

Question: As domestic oil production continues to plunge and the nations energy consumption continues to grow what is the likelihood of another surge in oil prices? If this surge were to occur, do you foresee the need for an arm of DOE to deal with potential pricing violations being recreated? How would this new organization differ from the Economic Regulatory Administration?

Answer: The likelihood of another surge in U.S. oil prices, comparable to the price shocks of the 1970s, is low. A potential cause of a surge in U.S. oil prices would be a reduction in U.S. oil imports caused by a severe oil supply disruption in the world oil market. However, the probability of such a disruption is estimated to be very low, about one percent per year. In addition, if one should occur in the world oil market, the United States and other major oil consuming nations could respond by releasing into the market large volumes of government-controlled oil stocks, which would reduce or eliminate the shortfall and limit any run-up in the world price of oil. By the end of 1990, over one billion barrels of strategic oil stocks will be held by the major oil consuming nations. Included in that volume will be about 596 million barrels held in the U.S. Strategic Petroleum Reserve (SPR). These strategic stocks could be drawn down and placed on the world market at a rate of about 4-6 million barrels per day during the first six months of a disruption.

Moreover, if major domestic accidents or severe weather in the U.S. should reduce U.S. supplies or sharply increase demand, the oil industry could respond quickly by drawing down inventories and increasing imports of crude oil or petroleum products.

The Federal Government's policy for responding to a disruption in U.S. oil supplies is to facilitate oil industry efforts to obtain replacement supplies, and if necessary, to release SPR oil into the market. Our experience in the 1970s demonstrated that price controls would most likely create additional shortages and lead to the inequitable distribution of petroleum product supplies.

IMPACT OF OIL IMPORTS

Question: We all recognize the economic and strategic importance of secure petroleum supplies and the contribution imported oil makes to the U.S. trade deficit. In January oil imports constituted 54% of domestic oil consumption, an all time record. In 1989 the imports were 46% of consumption. These imports cost the U.S. more than $49 billion, about 40% of the total trade deficit.

The petroleum industry is no longer finding the oil and natural gas needed to replace the reserves we are consuming. Leasing moratoria and recently stated DOI philosophy, to slow down the pace of leasing and decrease the amount of acreage to be offered, are keeping the nation from drawing on the potentially vast petroleum resources on the federal OCS.

What is your analysis of the cost to this nation of not increasing our domestic reserves and instead relying at an alarmingly increasing rate on oil imports?

Answer: Oil imports are now a major contributor to the U.S. trade deficit, amounting to 45 percent of the $109 billion deficit for 1989. However, the availability of lower cost oil imports provides economic advantages if competitively priced domestic oil is not available. To the extent that oil imports replace competitively priced domestic production, they deprive the economy of the net economic benefit of the domestic oil and gas that was not produced. That benefit is measured by the total value of the revenues from the sale of oil and gas less the total costs of the exploration, development, production and transportation incurred to bring the oil and gas to the point of sale. The loss of this economic benefit reduces income in the oil industry and in other industries that provide goods and services to the petroleum sector. This loss of income reduces tax revenues and economic activity in the oil producing regions of the country. However, protecting the nation's environment is a high priority particularly in sensitive areas. This priority must be carefully balanced against the energy and economic considerations and tradeoffs are necessary. Excessive and unnecessary damage to the environment is costly to repair and can negatively impact on industry and the economy as a whole. That is why the President has said he will proceed with development of OCS resources only in those areas where the risks are not too great.

WEDNESDAY, APRIL 25, 1990.

U.S. DEPARTMENT OF ENERGY

WITNESSES

ADMIRAL JAMES D. WATKINS, USN, RETIRED, SECRETARY OF ENERGY
ELIZABETH E. SMEDLEY, CONTROLLER
ROBERT H. GENTILE, ASSISTANT SECRETARY FOR FOSSIL ENERGY
J. MICHAEL DAVIS, ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY

Mr. YATES. This is the hearing on the budget for the Department of Energy's fossil fuels program for fiscal year 1991. Appearing in support of that budget is the distinguished Secretary of Energy, Admiral James Watkins, Retired. I saw "Midway" fought again last night on TV. Were you there by any chance?

Admiral WATKINS. No, sir. I was too young.

Mr. YATES. You make me feel old all of a sudden. [Laughter.]

He is supported by Ms. Smedley, Controller. Glad to see you again. You get younger every year.

Ms. SMEDLEY. Thank you.

Mr. YATES. Mr. Gentile, Assistant Secretary for Fossil Energy. You replaced that nice lady. What was her name? Donna Fitzpatrick. You're Mr. Davis. You replaced Ms. Fitzpatrick?

Mr. DAVIS. I'm a nice man. [Laughter.]

Mr. YATES. All right. Now we have the statement by Admiral Watkins, which may go into the record at this point.

[The prepared statement of Admiral Watkins and the biography of Mr. Davis follow:]

STATEMENT OF ADMIRAL JAMES D. WATKINS, USN (RETIRED)
SECRETARY OF ENERGY
Before the
COMMITTEE ON APPROPRIATIONS
SUBCOMMITTEE ON INTERIOR AND RELATED AGENCIES
APRIL 25, 1990

Mr. Chairman and members of the Committee, I am pleased to appear before you today to present an overview of the Department of Energy's FY 1991 budget request. This is the first budget prepared entirely by the Bush Administration, and it reflects new approaches in a number of technology areas as well as a new appreciation of the costs of past neglect.

The FY 1991 budget request for the Department of Energy is $17.5 billion, an increase of 6.4 percent over the FY 1990 level. I would now like to highlight several of the more important programs and initiatives included in this budget. In doing so, I will group the programs into categories which correspond to our present understanding of the emerging National Energy Strategy (NES), with modifications to permit discussion of the entire DOE budget, including those programs, such as defense and management oversight, which are not part of the NES. While the NES is seven months away from completion, the FY 1991 budget places higher priority on energy efficiency improvements and renewable technologies. This realignment of priorities is supported by the extensive public consultation process that the Department has been conducting since the summer of 1989 in conjunction with the development of the NES.

RESPECTING THE ENVIRONMENT

Managing facilities in an environmentally sound manner and restoring environmentally damaged sites are the highest priorities in the Department. The Environmental Restoration and Waste Management Five-Year Plan is the cornerstone of the Department's long-term strategy to vigorously manage DOE's cleanup activities. An Office of Environmental Restoration and Waste Management has been established to manage and direct Five-Year Plan activities.

The estimated cost identified by the Five-Year Plan is $19.0 billion for FY 1990-1995 for completing the highest priority activities (in addition to $0.7 billion for uranium enrichment cleanup). The $2.8 billion budget request for FY 1991 will fund activities necessary to prevent near-term adverse safety and environmental impacts, promote compliance with existing agreements, and implement regulatory standards and permits actions that could reduce risks or costs.

Nuclear waste disposal is another major priority of the Department. The program is structured around a "three-point" plan I announced last year. The plan centers on restructuring the Office of Civilian Radioactive Waste Management, initiatives to gain access to the Yucca Mountain site to continue the scientific investigations needed to evaluate the site's suitability for a repository, and an initiative for establishing an integrated Monitored Retrievable Storage (MRS) facility to begin spent fuel acceptance in 1998. The

FY 1991 Nuclear Waste Fund budget request of $292.8 million provides for continuation of the this three-point program.

INCREASING ENERGY EFFICIENCY AND SECURING FUTURE ENERGY SUPPLIES

In FY 1991, our commitment to conservation and renewables research and development is reflected in the 8 percent budget increase over the FY 1990 appropriation, and the 78 percent increase over the FY 1990 request. The FY 1991 budget request for conservation research and development alone is more than twice the FY 1990 request, and reflects the new priority the Department is according energy conservation. Using energy more efficiently and developing cost-competitive renewable energy will contribute to both a better environment and to reduced U.S. oil imports.

The FY 1991 budget request is also in line with recently announced FY 1990 initiatives to increase energy efficiency and the use of renewable energy sources. These initiatives are intended to substantially contribute to reductions in the production of so-called greenhouse gases, and to result in substantial energy savings.

The nuclear energy budget supports development of advanced light water reactors (LWRs), modular high temperature gas-cooled reactors (HTGRs), and advanced liquid metal reactors (ALMRs). An important new initiative will confirm the ability of an LMR, using the Integral Fuel Cycle (IFR) concept, to burn up the long-lived waste products in spent commercial light water reactor fuel. If successful, it could greatly reduce the requirements for long-term storage of nuclear waste.

The FY 1991 budget assumes commencement of close out of the Fast Flux Test Reactor (FFTF) in April 1990, following Congressional approval. Operation of the FFTF costs about $100-$115 million per year. Its continued operation would require identification of a long-term mission, which is not apparent. We examined various missions, including Pu-238 production, but none of these were deemed to be a cost-effective use of the FFTF.

The total FY 1991 budget request for Clean Coal Technology (CCT), including advance appropriations enacted in prior years, is $456 million. This will complete the funding for projects selected in Round 2 ($200 million) and Round 3 ($156 million), and will provide $100 million for the initial funding of Round 4 of the five-round program. The budget request also includes advance appropriations to become available in FY 1992-FY 1994 to fund the remainder of Round 4 and all of Round 5, which will complete funding for this major initiative. Industrial cost sharing in the 39 projects that are currently part of the CCT program has exceeded 60 percent.

I cannot leave the subject of Clean Coal Technology without conveying to you our strenuous opposition to a provision contained in the Clean Air Act amendments recently accepted by the House Energy and Commerce Committee that would alter fundamentally the character and purpose of the Clean Coal Technology program. Under H.R. 3030, as ordered reported, all unobligated CCT funds could be applied only to projects at plants owned by utilities with SOx or NOx emission reduction obligations under the bill. Rather than a national program for the demonstration of pioneering technologies that will help this nation use its abundant reserves of coal well into the future, the CCT program would become merely a way to have U.S. taxpayers subsidize the cleanup of plants owned by 63 utilities in as few as 21 states. I appreciate your support in working to correct this redirection of the CCT program.

The budget request for Fossil Energy Research and Development programs is about 23 percent higher than the FY 1990 request. This request is based on the need to place federal spending in the context of fiscal constraints, and to focus expenditures on those projects which industry is unlikely to support without assistance. Improved liquid and gaseous fuels extraction technologies are essential to increase domestic oil and gas supplies. A major new item in our Fossil Energy Research and Development budget is a $17 million geoscience initiative to support a regional/reservoir research program that will be jointly funded with consortia of States, industry and universities.

The President's budget proposes to make the Power Marketing Administrations (PMAs) operate in a more business-like manner through repayment reform legislation. The budget also proposes the sale of Alaska Power and the sale of the Georgia-Alabama system of the Southeastern Power Administration.

The Department continues to support legislation to create a government corporation to manage the uranium enrichment enterprise. We believe it is the best way to meet aggressive foreign competition in enrichment services.

FORTIFYING FOUNDATIONS

Maintaining scientific and technological preeminence is key to this Nation's ability to compete in the increasingly competitive world economy. Our support for basic research and development in such areas as High Energy and Nuclear Physics, Basic Energy Sciences, Biological and Environmental Research, and construction of the Superconducting Super Collider is essential to our future prosperity. The Department's budgets for these science and technology programs show increases across all major program elements.

Funding of $318 million is requested in FY 1991 for the Superconducting Super Collider (SSC), a proton-proton collider having an energy of 20 TeV per beam that will permit exploration of this new domain of physics research which cannot be reached by any other facility either in existence or planned. The SSC is a critical part of the Administration's initiative to strengthen the Nation's position as a world leader in science. Our support for the SSC does not mean diminished support for other, smaller, science projects. As mentioned above, all of the Department's major science programs are receiving substantial increases in the FY 1991 request.

The most recent review by the SSC Laboratory has identified cost increases. Consequently, the project cost, scope and schedule are now under review. We plan to build the SSC to the full power level originally proposed, 20 TeV per beam, so we will be studying these cost issues very carefully. In a project of this size some cost escalation seems unavoidable, but the Administration's commitment to the project remains strong.

Programs of major importance within Biological and Environmental Research include the human genome project and global climate change. The budget requests are $46 million and $66 million respectively, and our work is closely coordinated with other elements of the Government.

One of the most serious educational problems facing the Nation is the declining number of young Americans, including women and minorities, pursuing careers in science and engineering. As a major employer of technically proficient people, the Department has a major responsibility to ensure that the Nation's science education system is capable of meeting future requirements for manpower that can both extend the frontiers of science and manage increasingly demanding technology. The FY 1991 budget includes support for expanded pre-college science education which involves the Department's National Laboratories in local, State, regional, and national partnerships directed at improving pre-college science education.

STRENGTHENING NATIONAL DEFENSE

The Department of Energy contributes to national security through its defense programs and through certain non-defense activities which assure the Nation's preparedness for potential energy emergencies. The budget for our defense programs, including Naval reactors, is $8.5 billion, up from $7.7 billion in FY 1990. Of this increased funding, $500 million is required in FY 1991 to continue the intensive efforts begun in FY 1990 on critical operations improvements throughout the defense complex, particularly at the Savannah River Site and the Rocky Flats Plant.

A significant change in our nuclear materials production program is the decision not to build the Special Isotope Separation (SIS) plutonium facility, and to bring this research and development program to an orderly conclusion, completing ongoing experiments and documenting results.

In contrast to plutonium, our need for a source of supply for tritium remains critically important. A substantial portion of the defense budget is for improvements to reactor hardware, procedures, training, management systems and practices and maintenance, so that we can resume reactor production of tritium as soon as improvements can be made to ensure safe and reliable operation of the Savannah River reactors. Looking to the future, the New Production Reactor program continues to pursue two preferred reactor technologies and sites for new tritium production capacity: a heavy water reactor at Savannah River and a modular high-temperature gas-cooled reactor at the Idaho National Engineering Laboratory. The FY 1991 budget request for New Production Reactors is $363 million.

The Administration no longer is proposing to sell the Federal interest in the Elk Hills and Teapot Dome Naval Petroleum Reserves, but instead has a new proposal which may prove more acceptable to Congress. Under this proposal the fields would be leased competitively, with competition to be expressed in terms of the royalty rate bidders would be willing to pay the Federal government after also paying a lease bonus of $1.6 billion, $1 billion of which would be paid at the end of FY 1991. To ensure that the Department of Defense has a secure source of oil after NPR-1 is leased, the proposal provides for the creation of a 10 million barrel Defense Petroleum Inventory (DPI) to be stored in a cavern at the Strategic Petroleum Reserve (SPR), and filling it with oil over a five-year period beginning in FY 1992. The DPI cavern and oil fill will be funded from NPR lease royalty payments.

This proposal enhances energy security and defense preparedness and reduces the FY 1991 deficit by $1 billion. Draft legislation to permit and authorize the proposed leasing arrangement will be transmitted to the Congress shortly.

The FY 1991 budget request proposes the continued development of the SPR on a schedule to achieve the full 750 million barrels of storage capacity by the end of FY 1991 (capable of fill by the end of FY 1992), and the continued implementation of the ongoing program to increase drawdown capability to 4.5 million barrels per day. The budget also proposes to fill the SPR at a rate of approximately 59,000 barrels a day in FY 1991.

The legislation authorizing the SPR program expires in August 1990. The Department has prepared recommendations to extend the statutory authority and to increase the Department's drawdown flexibility in the event of a Presidential determination to use the Reserve during a supply disruption. A study mandated by Congress in 1989, on alternative methods of financing the SPR, was completed by the Department and transmitted to Congress on February 2. As a result of this study, the Department intends to seek discretionary authority to enter into negotiations with one or more major petroleum producers on a leasing arrangement for SPR oil. Under an oil "lease" or "option" concept, the Federal government would obtain control over the oil in the SPR, but without necessarily bearing the full cost of outright purchase. Our intention would be to implement these authorities within available budget resources, as set forth in the President's FY 1991 budget.

At the request of the President, DOE also carried out an interagency study of SPR size. The results of this study, transmitted to Congress on February 2 concurrently with the financing alternatives report, are that a 750 million barrel SPR will provide the U.S. with substantial protection against reasonably foreseeable future disruptions. These conclusions were reached after a comprehensive review of economic, foreign policy, energy security, and strategic considerations by a policy level steering group comprised of representatives of all federal departments and agencies with interest in the SPR.

MANAGEMENT AND OTHER ACTIVITIES

The budget proposes a major change to the Conservation Grants program. We believe that in view of the substantial resources made available to these programs from oil overcharge funds distributed to the States, there is currently no need to provide direct federal grants. Instead, we are proposing incentive funding for the States through the Weatherization Assistance Program. A total of $15 million is requested for two initiatives; $5 million to stimulate innovative programmatic approaches and $10 million to leverage non-governmental funding resources. Another $15 million is being requested for oversight and monitoring of State use of oil overcharge funds. It is expected that the funding requirements will be offset by funds from the Petroleum Overcharge Distribution and Restitution Act (PODRA) declared excess by the Office of Hearings and Appeals.

STAFFING

Many of the Department's most important programs have been adversely affected by difficulties in attracting highly qualified people in critical areas.

DOE is working closely with the Office of Personnel Management to develop legislation on a government-wide basis to establish a special salary structure for a limited number of very critical technical positions and to exempt a number of technical positions from the strictures of the "dual compensation" laws so that we might attract some highly qualified individuals to civilian federal service.

Mr. Chairman, I believe the Department of Energy's FY 1991 budget request is sound and strongly supports our energy, science, and defense missions with a proper regard for the environment and for the health and safety of our workers and the citizens of the United States. I look forward to working with the Congress to achieve these objectives.

U.S. Department of Energy
Office of the Secretary
Washington, D.C. 20585
202/586-5534

BIOGRAPHY

J. MICHAEL DAVIS

J. Michael Davis was sworn in on October 6, 1989, as Assistant Secretary for Conservation and Renewable Energy, U.S. Department of Energy (DOE). The Office of Conservation and Renewable Energy conducts research and development programs in energy efficiency and renewable energy for buildings, industry, transportation and utilities. Its programs in renewable energy resources involve research in active and passive solar, photovoltaic, wind, ocean thermal, geothermal and biomass technologies.

The Office also administers Federal grant programs for low-income home weatherization and energy efficiency improvements in schools and hospitals, and coordinates management of three of the five federal power marketing administrations.

Since 1982, Davis has owned and operated private businesses providing solar and energy efficiency products and services in Denver, Colorado.

Earlier, he held positions with the Solar Energy Research Institute in Golden, Colorado, as Manager of Planning and Special Programs; Acting Associate Director for Analysis and Applications: and Buildings Division Manager from 1980 to 1982. At DOE Headquarters, he served as a manager in the solar program from 1977 to 1980.

Davis is a distinguished graduate of the U.S. Air Force Academy (B.S. 1969) and the University of Illinois (M.S. 1970). He served in the Air Force from 1969-1977, and received the Bronze Star and the Vietnam Honor Medal. Davis is also a registered Professional Engineer.

Davis lives in the Washington suburb of Alexandria, Virginia, with his wife and four children.

October 1989

DOE'S INTERIOR APPROPRIATIONS

Mr. **Yates**. Admiral, we're very glad to hear what you have to tell us. I have the impression—and you correct me if I'm wrong—that your problems in the nuclear part of the Department of Energy are so formidable and huge that you can't spend very much time with us for this portion of the budget. Is there truth to that?

Admiral **Watkins**. Well, there is some truth to that, Mr. Chairman. I think that I have been blessed with somewhat of a clone in Henson Moore. He is my deputy. He has an oil and gas background. He and I are very close together—

Mr. **Yates**. Out of Louisiana, he would be.

Admiral **Watkins**. We talk to each other all of the time. We are very close. He is moving in directions that I understand that he is taking care of. We share that information, and I think we have a strong team. That has helped a great deal. I think you are right. I would like to spend more time on tinkering inside R&D budgets and a lot of things, and I have to spend a lot of time on program execution.

It is tough, but I have, as they say, been blessed with a superb deputy. I now have a team on board finally. It has taken a long time to get Mr. Gentile, Mr. Davis, and others on board. I have been hanging on with my fingertips here for about a year, so we are getting stronger now, and we're going to make it. I can devote more time now to the strategy, the longer term thinking and the budget preparation in greater detail.

Mr. **Yates**. Would it help you or hurt you to separate the Department of Energy into the two different activities—the nuclear and the non-nuclear?

Admiral **Watkins**. Basically, the Department is split up that way, Mr. Chairman, now. I don't think it would be a good idea because there are so many cross-cutting issues such as environmental waste management and so forth that pull us together. Also, the National Laboratories really serve everyone. I have weapons laboratories and non-weapons laboratories interfaced. The whole waste management issue is now becoming nearly a $4 billion a year budget so it forces us back together again in many ways.

Mr. **Yates**. Go ahead.

INTRODUCTORY STATEMENT

Admiral **Watkins**. Mr. Chairman, members of the Committee, I am pleased to appear before you once again today to present the overview of the Department of Energy's fiscal year 1991 budget request. This is the first budget prepared entirely by the Bush administration, and it reflects new approaches in a number of technology areas as well as a new appreciation of the costs of past neglect.

The fiscal year 1991 budget request for the Department of Energy is $17.5 billion, an increase of 6.4 percent over the fiscal year 1990 level. My written statement for the record summarizes the entire budget, and I would like to focus my oral remarks then on major programs under the jurisdiction of this committee.

CONSERVATION AND RENEWABLE ENERGY

In fiscal year 1991, our commitment to Conservation and Renewables Research and Development is reflected in the 8 percent budget increase over the fiscal year 1990 appropriation and the 78 percent increase over the fiscal year 1990 request. There was a pledge on my part to review these budgets last year in light of our emerging energy strategy.

I think this has been a very helpful review over these past few months listening across the Nation and recognizing that we have not done our job well in this whole area of conservation and renewables. This is why I asked Mr. Davis to join me here today. If you have any additional questions there, I think it might be useful for the Committee to hear him.

The fiscal year 1991 budget request for Conservation Research and Development alone is more than twice the fiscal year 1990 request and reflects the new priority the Department is according energy conservation. Using energy more efficiently and developing cost-competitive renewable energy will contribute to both a better environment and to reduced U.S. oil imports.

The fiscal year 1991 budget request is also in line with recently announced fiscal year 1990 initiatives to increase energy efficiency and use the renewable energy sources. These initiatives are intended to substantially contribute to reductions in the production of so-called greenhouse gases and to result in substantial energy savings.

CLEAN COAL TECHNOLOGY

The total fiscal year 1991 budget request for the Clean Coal Technology Program, including advance appropriations enacted in prior years, is $456 million. This will complete the funding for projects selected in Round 2 of $200 million, in Round 3 of $156 million, and will provide $100 million for the initial funding of Round 4 of the five-round program.

The budget request also includes advance appropriations to become available in fiscal years 1992 through 1994 to fund the remainder of Round 4 and all of Round 5, which will complete funding for this major initiative. Industrial cost sharing in the 39 projects that are currently part of the Clean Coal Technology Program has exceeded 60 percent.

CLEAN COAL TECHNOLOGY ISSUES

There are several issues concerning clean coal technology that I would like to address directly. The WEPCO decision still remains a threat to current and future participants in the Clean Coal Technology Program. We are continuing to work with both EPA and Congress to resolve the issue. While EPA has expedited resolution of some project-specific issues in a satisfactory manner, we continue to encourage EPA to seek a permanent long-range solution to the problem.

At the same time, we are working with Congress on legislative remedies which may be necessary to fully protect the program. The Department's Program Opportunity Notice for Round 4 contains changes to some key provisions. We have been discussing these changes with staff of the Appropriations Committee, but there are still issues to be resolved in the area of repayment.

Existing statutes require that we publish this PON on or before June 1, 1990, and we will do so unless otherwise directed by the Congress. It is my hope that we can resolve the remaining issues promptly. I would like very much, Mr. Chairman, to meet with you and any other members of the Committee in the very near future and find resolution because I believe we can come to resolution. My only intent on repayment is to ensure that we don't do anything that would impede execution of clean coal technology in Rounds 4 and 5. I believe it is so critical to the long-range interest of the Nation that I want to do that.

If you find our language that we have been working on with you unacceptable, I need to talk to you and the members involved. I believe we can come to a resolution that will be satisfactory.

Mr. YATES. Okay.

Admiral WATKINS. Finally, I cannot leave the subject of clean coal technology without conveying to you our strenuous opposition to a provision contained in the Clean Air Act amendments recently accepted by the House Energy and Commerce Committee that would alter fundamentally the character and purpose of the Clean Coal Technology Program. Under H.R. 3030, as ordered reported, all unobligated Clean Coal Technology funds could be applied only to projects at plants owned by utilities with SO_2 and NO_X emission reduction obligations under the bill.

Rather than a national program for the demonstration of pioneering technologies that will help this Nation use its abundant reserves of coal well into the future, the Clean Coal Technology Program would become merely a way to have U.S. taxpayers subsidize the cleanup of plants owned by 63 utilities in as few as 21 States. I appreciate your support in working to help correct this redirection of the Clean Coal Technology Program.

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

The budget request for Fossil Energy Research and Development Programs is about 23 percent higher than the fiscal year 1990 request. This request is based on the need to place Federal funding in the context of fiscal constraints and to focus expenditures on those projects which industry is unlikely to support without assistance. Improved liquid and gaseous fuels extraction technologies are essential to increase domestic oil and gas supplies. A major new item in our Fossil Energy Research and Development budget request is a $17 million geoscience initiative to support a regional reservoir research program that will be jointly funded with consortia of States, industry, and universities.

NPR–1 LEASE PROPOSAL

The Administration no longer is proposing to sell the Federal interest in the Elk Hills and Teapot Dome Naval Petroleum Reserves. Instead, there is a new proposal which may prove more acceptable to Congress. Under this proposal the fields would be leased competitively, with competition to be expressed in terms of the royalty rate bidders would be willing to pay the Federal Government after also paying a lease bonus of $1.6 billion, $1 billion of which would be paid at the end of fiscal year 1991.

To ensure that the Department of Defense has a secure source of oil after NPR-1 is leased, the proposal would provide for the creation of a 10-million-barrel Defense Petroleum Inventory to be stored in a cavern at the Strategic Petroleum Reserve and filling it with oil over a 5-year period beginning in fiscal year 1992. The Defense Petroleum Inventory cavern and oil fill will be funded from NPR lease royalty payments.

This proposal enhances energy security and defense preparedness and helps reduce the fiscal year 1991 deficit by $1 billion. Draft legislation to permit and authorize the proposed leasing arrangement will be transmitted to Congress shortly.

SPR PROGRAM

The fiscal year 1991 budget request proposes the continued development of SPR on a schedule to achieve the full 750 million barrels of storage capacity by the end of fiscal year 1991, capable of fill by the end of fiscal year 1992, and continued implementation of the ongoing program to increase drawdown capability to 4.5 million barrels a day. The budget also proposes to fill the SPR at a rate of approximately 59,000 barrels a day in fiscal year 1991.

Legislation authorizing the SPR program expires in August 1990. The Department has prepared recommendations to extend the statutory authority and to increase the Department's drawdown flexibility in the event of a Presidential determination to use the Reserve during a supply disruption. A study mandated by Congress in 1989 on alternative methods of financing the SPR was completed by the Department and transmitted to the Congress on February 2.

As a result of this study, the Department intends to seek discretionary authority to enter into negotiations with one or more petroleum producers on a leasing arrangement for SPR oil. Under an oil lease or option concept, the Federal Government would obtain control over the oil in the SPR but without necessarily bearing the full cost of outright purchase. Our intention would be to implement these authorities within available budget resources as set forth in the President's fiscal year 1991 budget.

CONSERVATION GRANTS PROGRAM

The budget proposes a major change to the Conservation Grants Program. We believe that in view of the substantial resources made available to these programs from oil overcharge funds distributed to the States, there is currently no need to provide direct Federal grants. Instead, we are proposing incentive funding for the States through the Weatherization Assistance Program. A total of $15 million is requested for two initiatives; $5 million to stimulate innovative programmatic approaches and $10 million to leverage non-governmental funding sources. Another $15 million is being requested for oversight and monitoring of State use of oil overcharge funds. It is expected that the funding requirements will be offset by funds from the Petroleum Overcharge Distribution and Restitution Act declared excess by the Office of Hearings and Appeals.

Mr. Chairman, I believe the Department of Energy's fiscal year 1991 budget proposal in the areas of particular interest to this Committee are sound and strongly support our energy, science, and defense missions. I look forward to working with the Congress to achieve these objectives and stand by for any questions you may have.

NATIONAL ENERGY STRATEGY

Mr. YATES. Thank you very much, Admiral, for your excellent statement. Just as we had announcements about new programs that this Administration has undertaken, we have had an announcement of a new National Energy Strategy, which your department is preparing for President Bush. What is new about the National Energy Strategy? I have the impression that since the 1970s, the shortages that took place there, and the new programs that were initiated—many of which were abandoned and some of which were continued in existence only as a result of appropriations maintained by this Committee, that we have an energy strategy. What is the new energy strategy that you propose?

Admiral WATKINS. Well, it isn't proposed yet. The interim report, Mr. Chairman, is a compendium of the public's comments organized in the format of the final report that we hope to get to the President in December of this year. Our attempt was to build awareness in the Nation of the issues and the complexity of those issues, expose ourselves to what the grass roots are saying in various regions of the Nation on the issue of regulatory barriers, any legal barriers, any self-imposed barriers, any conflicts between competing entities for energy sources, and all those kinds of things.

We listened to them and, frankly, we learned a lot we had never mentioned before in our biennial report to Congress on energy policies. In fact, past energy policies were not action plans. They were statements of situations. They weren't all that useful to the Congress. The people on the Hill didn't tell me they were very useful.

I think this document that we have coming to you will identify all of the areas, which will include a number of things not heretofore even mentioned by the Department of Energy, such as transfer of technology. We have $71 billion of American research effort, and yet we don't leverage that back into our own economy. We are providing new concepts that we are working on with Congress up here in many of the committees to try to leverage those dollars back into our own economy.

The very things we are doing in waste management, the exciting things in new energy concepts for the future—the first thing we know, we'll transfer the technology offshore and then have it sold back to us. We will contribute more to the trade deficit and more of our lack of economic growth. That is in there. Education is a major issue.

Mr. YATES. That is also in our hearings for the past three or four years. That is why we are going for more money for fuel cells and a few of the other things because we are competing with the Japanese.

Admiral WATKINS. Well, we're trying to, of course, assemble that now in an orderly fashion, say "What are the obstacles?" and then identify the actions to eliminate those obstacles. Hopefully we can come forward with an integrated package that says, "Let's balance those playing fields across all sources, across environment, science, and economics."

Mr. **Yates**. I think that this Committee has tried for years to point out that we wanted the previous Administration, as well as this one, to suggest ways of persuing the kind of transition from basic research and the next steps in research programs into use by business and by industry. I'm glad to see finally that some transition is being——

Admiral **Watkins**. Well, I couldn't agree more, Mr. Chairman. As you know, the Congress passed a bill last year on this very issue, and we are now moving aggressively to expedite it and have all of our milestones on track. I think you are going to see that this will be one of the major national initiatives to get competitive internationally.

IMPLEMENTATION OF NATIONAL ENERGY STRATEGY

Mr. **Yates**. Yes, but your target date for putting that into effect is 1993. What are you going to do until fiscal year 1993? Is my impression correct?

Admiral **Watkins**. No, sir. We are going to do everything we can to complete our work in such time as to have a budget adjustment to OMB by the 15th of November of this year for the fiscal year 1992 budget submission. When the President announced it, we were on the way. We were running with it in the right direction.

Mr. **Yates**. All right.

Mr. **Regula**. Will you yield, Mr. Chairman?

Mr. **Yates**. Sure.

Mr. **Regula**. As I understand it, Admiral, what you're going to do in terms of an interagency energy policy will be a long-term policy as opposed to what you've just described. Is that correct?

Admiral **Watkins**. It will be near-, mid-, and long-term. It will have ramifications starting in the 1992 budget and will be looking out to the year 2030 in the long term. This is what we must do in energy. You have to look out to see what is possible out there in the way of technology and then back it down to what we're doing today to see if it makes sense.

Mr. **Regula**. So it will be sort of a continuum in each budget that will reflect some additional work.

Admiral **Watkins**. This will be a dynamic strategy. We have a national energy modeling system being developed. All of this will be a continuing exchange with the Congress every other year when we come up with our report saying that what we're doing we hope is consistent with the strategy that both the Congress and the Executive Branch can agree to as the logical approach to achieving near-term, mid-term, and long-term objectives.

Mr. **Regula**. Thank you.

Mr. **Yates**. Will there be public comment on the draft proposal before it is sent to the President?

Admiral **Watkins**. There will be a series of public hearings that will commence this summer, again, to focus on specific elements that we did not cover well in the first 15 hearings. Some of those hearings will be held on potentially contentious issues such as regulatory barriers, or such as the economics that we are using for fuel cycle costs, and so forth. We have a lot to learn still that we're going to flush out over the next several months, working in the interagency group, as to what we really still need before we can come to grips with the final strategy.

What we will give to the President will be a variety of options to deal with the issues, and those options will be presented to him. The degree to which those options are re-aired, I'm not sure, Mr. Chairman. We haven't come to grips with just how that is going to be handled. Those are now out in the interim report. We're asking, "Do we have all of the options out there? Did we cover all of the issues? Do we have the right kinds of things covered?" Many of the people, as you know, will say, "We need to go in that direction; no more fossil," or "We need to go and accelerate the fossil program." We have people recommending things in diametrically opposed directions, and so we're going to have to come to grips with the hard decisions on that and try to come up with something that is fair and equitable across the various issues.

Mr. **Yates**. Mr. Regula?

Mr. **Regula**. Thank you, Mr. Chairman.

Admiral, as one who is very much interested in the whole energy problem, I am very impressed and pleased with your leadership in the Department. I think energy was an area that was crying for some new directions. It is not a subject that makes the evening news very often but, in an era when we seem to have plenty, people don't want to focus on it. As we've just finished Earth Week, the focus has been entirely on the environmental side of this without thinking in terms of the future.

I spoke to a high school assembly Monday on Earth Day and, of course, the teacher said, "Well, isn't the solution that we have the esoteric sources of energy such as wind, solar power, and so on?" How would you have responded to them?

UTILITY SECTOR

Admiral **Watkins**. Well, I think that, frankly, all sources of energy to me are necessary for the national good. We just have to manage them right. I believe that various incentive packages to encourage certain things to be done are important. I think we have not done a good job in integrated resource planning across the Nation.

When we went out on our hearings, we listened in the Northwest region, for example, to a very exquisite explanation of how new power sources are allowed to be brought on the line in the Northwest region. They have to go through a conservation efficiency check-off list and make sure that it is necessary and that they can't solve the problem by other means. I think that is a very credible thing to do. It forces new transmission line access procedures. It forces a lot of consideration that may solve the problem, so that we don't generate unnecessarily pollutants that we know eventually add to the problems facing Mother Earth.

I think that those kinds of things that we're learning are realistic. We don't do a good job of encouraging efficiency or encouraging conservation. You're seeing major utilities now really stepping out on this. The utilities in the West and in the Northeast are moving out aggressively in incentivizing conservation. This makes a big difference.

I believe what we're looking at here is the possibility of perhaps even doubling the offsets we would otherwise need for electrical generation by conservation efficiency steps. I think it is realistic. I think to say that is the answer is, unfortunately, going way too far. That might be worth 25 percent of an offset of the growth of 110 gigawatts, but we still have to have the others, and we still are not building the plants to do that.

Now what plants should we build? Well, we've got a variety of plants that we can build. I think that, clearly, for places that have wind, such as Hawaii where I was up on a three and a half megawatt wind generator, wind generators are a possibility. We saw the wind generator down here in D.C., and it never turned once during Earth Day. [Laughter.]

We have to be realistic. Wind is a requirement for wind machines.

Mr. YATES. You should have moved it. [Laughter.]

Admiral WATKINS. You have to look at the 1,000 wind machines on the way to Palm Springs from Los Angeles. You see them all idle. It gives you a feeling about what the environmental impact is of 1,000 wind machines not turning. I think that these are the things we have to be realistic about. Wind machines are good where wind is available on a continuing basis. We are doing a lot of research on advanced wind machines so that we can have variable speed wind machines. Geothermal is an area that can be expanded in Hawaii, yet the environmental opposition to that is extreme.

We have a lot of renewables and things that are possible, but even they have environmental problems associated with them. There are a lot of people that aren't pounding the table as hard about that now. In the areas of photovoltaics and solar-thermal heating, I think we have got some real possibilities there.

I really believe that in the next edition of electric vehicles for urban use that we'll see photovoltaics combined with storage battery capacity to give us an electric car that can go 300 miles a day and be partially charged by the sun when it is out and then at night when the loads are low. I think those are definite possibilities.

Mr. YATES. Only if you can clear off the smog in the cities like Chicago, New York, and Los Angeles.

Admiral WATKINS. The electric vehicles don't go well at night.

Mr. YATES. The problem is the smog extends the time for——

Admiral WATKINS. Well, I don't think there is any quick answer to any of these. Clearly, there is no——

Mr. YATES. I know they have photovoltaics in Israel and in a few of the other countries where they had them built into the top of their cars. They were using them as part of the supplemental energy.

Admiral WATKINS. Mr. Davis can correct me, but I think we probably have on the order right now of 5,000 megawatts coming in from a variety of these kinds of sources. That is small percentagewise, but it is important for the future. I think that there is no question in my mind, listening to the energy comments so far in the hearing, looking at the data, that oil is going to be here for some time to come.

No matter how aggressive and how successful we are in alternative fuels, we are going to be still importing oil, up to 60 percent by the end of the decade, perhaps higher after that, and it will be some time before we will bend that curve over with a very aggressive R&D effort and a very aggressive program on clean air and so forth. So we do have to worry a lot about in the transitional period over the next 40 years from primary dependency on oil to transportation by——

Mr. YATES. I've heard that from Mr. Regula. [Laughter.]

NUCLEAR WASTE DISPOSAL

I just want to ask a question. There seems to be a resurgence in some quarters of the need for nuclear energy. Can you really have a fulfillment of nuclear energy for civilian purposes without knowing what we're going to do in disposing of the waste?

Admiral WATKINS. I don't think you can, no.

Mr. YATES. For years—maybe it's as long as 20 years since we first began to ask this question—we were told periodically year by year that disposal of waste isn't a problem. We went from swimming pools into concrete containers into glass containers into various kinds of salt domes. I understand we still haven't found a proper way of disposing of it. What are the French doing? I'm told they put it in some kind of a swimming pool contraption. They've got to face up to that before the——

Admiral WATKINS. Well, they have solved a portion of their problem, Mr. Chairman. I visited their plant at Marcool. It is an integrated fuel cycling process there. It is excellent. In a room maybe four or five times this size, you see 10 years of burial of a high-level of spent fuel element waste coming in from their various reactors. That isn't the only waste they have to worry about. They have a lot of other high-level waste that has to be buried. They are going out and——

Mr. YATES. How do they bury it?

Admiral WATKINS. Well, they don't. It is on top of the ground, but they're looking for repository sites. They've just gone out with a survey in six cities, and all six cities have been turned down because of environmental concerns. The popular referendum says, "not in my town." We're facing a long-term problem that is worldwide.

My belief is that it will go something like this. You've hit on a very key element. This probably is the long pole in the tent for the future of fission nuclear energy. We will probably open this fall within New Mexico a facility for defense-level waste—transuranic waste. We'll start the research project to determine whether or not long-term transuranics can go in those salt domes. We won't know the answer to that for years. In fact, we probably won't know it really for five years, somewhere between three and five years.

We're sitting here generating transuranic waste for that period of time, and it will have to be stored in a variety of areas. We're looking at alternative storage sites in the interim period while we do the research. We'll be successful, in my opinion, in opening that site this fall. That is a major milestone in the national thinking about whether we can bury waste of this kind for 10,000 or more years safely. Nobody has ever done it in the world. We will be the first. We have had 14 nations visit that particular site. They are very interested in knowing how we're going to do it.

That is defense waste. It is different from the commercial waste, but it is a similar concept at Yucca Mountain. You know the controversy at Yucca Mountain. Congress passed a law that said you'll study it and see if it is a suitable site. The State has said, "No, you won't come into our State." We're in the courts now in the Ninth Circuit, and hopefully that will be resolved by this fall.

If so, we will get on with the research work to determine whether or not that is appropriate storage for the high-level commercial waste that is essential for the first generation reactors. We are not building any new reactors. As you know, we haven't put any new plants on the street since 1978 and won't until the year 2000, so there are no new plants except those that were conceived before. There is a handful that will still be coming on. I think there are five left. Comanche Peak and a few others are beginning to roll on line now.

What we're seeing here is a very important determination period in this next decade as to whether or not we can deal with the old reactors. In my opinion, that will have, in large measure, an impact on the public thinking about future reactors. I think we are going to solve it, I think our future reactors are going to work, and we will not generate these wastes again. The design that we are working on right now in R&D not only gives us the advanced light water, but associated with that we have an integral fast reactor which will go with it to burn up the so-called actinide. These are the long-term bad actors that require us to go into a long-term repository. With those being fissile, you can burn them up in liquid metal reactors.

You need about one of those for every five light waters, and you don't get into this problem again. Now you have a 200-year storage problem which, by everybody's standards in the world, could be put above ground for that period of time and safely monitored so our follow-on generations could be assured. We're good enough, we think, to monitor things for a couple of hundred years. We're not sure we can monitor them for 10,000, however.

Mr. YATES. Do you want to build nuclear power plants?

Admiral WATKINS. Before I answer the question, I think we need to solve that problem. We need to get to the streamlined single design, and the one-stop licensing process has to be in place. We have to show that that is cost effective. We have to convince the American people that we can run these things safely. I think we can. That it is an inherently safe design. We do not need external power. It is inherently and passively safe.

I think once we get that education process in this next 10 years going, the answer is not only do we want them, I think we have no alternative. I think we have to have it and we have to do it in a new way that doesn't generate the problems of old technology that have been given to us to date.

ALTERNATE ENERGY SOURCES

Mr. **Yates**. You have low energy prices at the present time. Will this affect your recommendations to the President as to the transition from research to utilization of your discoveries of energy alternatives?

Admiral **Watkins**. Yes, sir. It will definitely have an impact. We cannot ignore the volatile picture of those prices. They make a big impact on us economically in the country, so we have to take that into account.

Mr. **Yates**. Is this going to affect photovoltaics for automobiles?

Admiral **Watkins**. I think it will. I think it will enhance the people's interest in weaning themselves away from oil without any question. In that sense, it is good news. The bad news is that we hurt ourselves sometimes economically, and we're extremely worried still about the potentially unstable sources, which will be primarily the Middle East, where we get about 25 percent of the imports.

CONSERVATION TECHNOLOGY DEMONSTRATION

Mr. **Yates**. Have you given any thought to supporting technology demonstrations and conservation through a program similar to the Clean Coal Technology Program where industry would cost share at least 50 percent of the demonstration of the——

Admiral **Watkins**. May I ask Assistant Secretary Gentile to answer that question? He would have more detail on that. Or Mr. Davis—one of the two. You're cutting across both areas.

BUILDINGS SECTOR

Mr. **Davis**. Sir, actually, we are trying to emulate that in one of the initiatives that we touched on—relighting Federal buildings. There is always the question of whether or not there is money available to do those sorts of things. We are not ready to announce that specifically today, but we think we can bring $20 million to play from both the Federal and private sectors on relighting Federal buildings. I think within a month or so we'll be in a position to announce that.

Mr. **Yates**. What do you mean by relighting them?

Mr. **Davis**. Improving the technology of lighting, changing from the current product that is inefficient to products that are available today that operate at half the energy requirements. There are products available today. It is a matter of moving those into the market, and we think the right partnership with the private sector will accelerate that. We're looking for those examples, within the Federal Government, DOE, and other agencies.

Mr. **Yates**. Have you done that anywhere yet?

Mr. **Davis**. Yes, sir. We have some examples of that. I think some of our demonstration work and some of our testing work in the Federal fleets—the Alternative Motor Fuels Act—is an example where we are assisting the procurement, actually, of fleets and the testing of those fleets on alternative fuels. I think it would be something in that direction.

Mr. **Yates**. I was wondering whether you had any buildings that you had converted over to your new lighting yet. You were talking about $20 million for the purpose.

Mr. **Davis**. Yes, sir.

Mr. **Yates**. Are there in existence any pilot programs?

Mr. **Davis**. There clearly are.

Mr. **Yates**. Can you tell us where they are?

Mr. **Davis**. Yes, sir. There are some along the West coast, for example, where States have worked with utilities. Some Federal money has been involved in that actually. They take buildings and demonstrate that they can be substantially better. There are some along the East coast. There are some utilities that have actually taken action with——

Mr. **Yates**. If a reporter were to ask some member of this Committee where they could see some of these demonstrations where would we say? Could you please put in the record some of the buildings where these have taken place?

Mr. **Davis**. Yes, sir. You know we're going to be up here Friday, I can bring you examples at that time.

[The information follows:]

BUILDINGS THAT DEMONSTRATE ENERGY CONSERVATION

The Energy Edge buildings in the Pacific Northwest are among the better known commercial buildings demonstrating energy conservation technologies. The Bonneville Power Administration is conducting the Energy Edge project to demonstrate the energy and cost performance of efficiency improvements designed to reduce commercial building energy requirements by 30% over current practices. The project is funding the increase in design and construction costs in 29 commercial buildings located in Western Oregon and Washington. A range of building types and sizes are included in the project, with office buildings being the most common type. The typical conservation measures being examined are lights and controls, advanced HVAC systems and advanced envelope systems. The project activities are being conducted in cooperation with the Oregon State Department of Energy, Washington State Department of Energy, Pacific Power and Light and Portland Energy Conservation, Incorporated.

Several years ago DOE sponsored various projects demonstrating energy conservation technologies in residential buildings. Three of the better known are the Brookhaven House on the grounds of the Brookhaven National Laboratory, the Blavin House in Vermont, and the Minimum Energy Dwelling in California. Subsequently, other residential demonstrations have been constructed with private funding. These include two Roki Houses in Maine, one of 1540 sq. ft. and one of 3000 sq. ft., that have annual heating costs of about $150 and $375 respectively; the 2100 sq. ft. Sklare House in Indianapolis with annual heating costs of about $150; and the 2128 sq. ft. Buffalo Homes houses in Montana with annual heating costs of about $300.

In recent years, Congress has directed the construction of several university facilities which demonstrate energy conservation design techniques. These large, cost-shared projects include the Materials Science Facility at Northwestern University in Evanston, Illinois, and the Center for Complex Systems at Brandeis University in Waltham, Massachusetts. Additionally, the Child Development Centers planned for the Department of Energy will use energy conservation as a major element in design.

Mr. **Yates**. You're going to be here on Monday instead of Friday.

Mr. **Davis**. Okay.

Mr. **Yates**. If you have no objection. [Laughter.]

Mr. **Davis**. We will bring examples.

Mr. **Yates**. Okay.

Admiral **Watkins**. But clearly, Mr. Chairman, we have not built a program at the Federal level, and we have to do that. Mr. Cheney has written me a letter saying, "Would you please help me out on my annual fuel bills? They are preposterous." And they are. We can help them. We replied back, "Here is what we have to do. You have to make some up-front investment; it isn't that significant. You can amortize in three years." So we have to start doing that in the Federal Government. I think the DOE building is probably one of the worst examples of efficiency in the Nation. This is a——

Mr. YATES. Deliberately? [Laughter.]

ENERGY EFFICIENCY

Admiral WATKINS. No. I don't think we were that conscious in the mid-1970s when we were building it. I think these are the kinds of things that we have to get serious about. We're talking about significant amounts of megawatts that we can avoid by this. This isn't just——

Mr. YATES. Is there money in your budget to do this?

Admiral WATKINS. We have money——

Mr. YATES. Have you got the $20 million in your budget?

Mr. DAVIS. No, sir. We're talking about money that is both in other Federal agencies' budgets and also in the private sector. If you allow the utilities, which in many cases are currently precluded from investment in energy efficiency, if you can find a way to involve them because they indeed——

Mr. YATES. Why are they precluded?

Mr. DAVIS. Because there is not the same treatment for investments in energy efficiency that there is for treatments in new supply. The utility is basically encouraged to build more capacity. Their whole rate of return is based on selling more kilowatt hours.

Mr. YATES. Is this the doing of the railroad and public utility commissioners who refuse to——

Mr. DAVIS. Well, I think over time that the utilities really believed that was their best investment. Public utility commissions are indeed trying to regulate that and provide greater return. I think in many cases it is a matter of providing better information so they understand that there are other options. We are, in fact, working with those State regulatory commissions to change some of the regulations that will allow utilities to earn their rate of return on investments that reduce the demand for their product. In other words, incentivize them to make those investments rather than penalize them for making the investments.

Admiral WATKINS. We will be making specific recommendations along those lines on that one item. That is the kind of thing that will be in the energy strategy. We will be coming to Congress saying we ought to have either legislation here, or we ought to encourage States to have legislation and incentivize them to make those changes so that we do provide this kind of incentive and we don't unbalance the system away from alternatives to building new electrical carrying capacity.

Mr. YATES. Is there any way of developing a partnership between that State and the Federal Government in drafting a——

Admiral WATKINS. Absolutely.

Mr. DAVIS. Yes, sir, there is.

Mr. YATES. Are you working on that now?

Admiral **Watkins**. Yes, sir.

Mr. **Davis**. Some of that money that we talk about in terms of petroleum violation escrow funds are yet to be spent. Indeed there are States—we have had discussions directly with both States and utilities within those States—and we have projects that we're bringing together now that will use those funds in a very positive way.

ELECTRIC VEHICLES

Mr. **Yates**. You've had I'd say about 10 years working on storage batteries. Why haven't you made more progress? Why haven't you solved the problem of storage batteries for automobiles?

Mr. **Davis**. Well, I think part of the answer is we have looked at every possible battery pair that anybody could think up. We've spread our effort over many, many different approaches, different battery pairs, as you may be aware.

Mr. **Yates**. We're aware.

Mr. **Davis**. What we're trying to say is that you'd do better if you narrow the number that you're working on. You will have a better relationship with industry so that they're actually involved in more cost sharing and the choices. We did narrow the pairs that we're working on in our 1991 request. It comes down to sodium sulphur, zinc bromine, and lithium metal sulphur. We are actually spending more money. We are requesting more money for those three than was appropriated in fiscal year 1990.

Mr. **Yates**. I had the impression that you were the one who had selected the manner of research and that with scattershooting you thought perhaps you'd find a way that you wouldn't find if you limited your research to one or two methods. Now you want to pull everything together. Is it because you found the most promising ways, do you think?

Mr. **Davis**. I think we realize that we're going to have to focus to be successful, and it will probably take more money.

Mr. **Yates**. How do you propose to focus that?

Mr. **Davis**. Well, we have based it on a number of discussions with the science——

Mr. **Yates**. Well, are you focusing with Ford? GM? How are you doing it? They are building your cars for you, aren't they? They're working on the engines. General Motors has just come out with the announcement that they now have an electric car.

Mr. **Davis**. Yes, sir.

Mr. **Yates**. You may not have a battery but they've got an electric car, right?

Mr. **Davis**. Two weeks ago I was in their technical center talking about both battery work and turbine work.

Mr. **Yates**. Okay. What did you learn in their center?

Mr. **Davis**. They encouraged us to focus, and they have quite a different attitude about participating with us. Ford has been more of a participant than General Motors. General Motors is, I think, substantially more interested now, particularly in the battery issue and would like to work jointly with us as opposed to working on their own. Clearly, they can provide the integration. I don't think we have to worry about integrating a whole bunch of things into a vehicle. They can do that. If we work on the battery jointly, I think they can accomplish the rest of it from there.

ELECTRIC VEHICLE BATTERIES

Mr. YATES. Is the only thing that remains precluding a successful electric car the battery problem?

Mr. DAVIS. I think a battery is the biggest issue. I think the inverter is probably the second largest issue. Through the Ford program we have been able to reduce the inverter weight by about half and the cost by about 20 percent, so there is some progress on that topic. I think the major stumbling block right now is, indeed, the battery.

Mr. YATES. You now have a battery. How big is your battery? Is it a 120-mile range battery? How big and how heavy is it?

Mr. DAVIS. Typically, those will run about 350 or 360 pounds. When you put all of those together in a block, if you will, it is part of the impact.

Mr. YATES. I don't know how big it is when you——

Mr. DAVIS. Physically, I would say it is about nine inches wide and about six or seven feet long. It is the full length of the car.

Mr. YATES. Do they still have——

Mr. DAVIS. It is about a $2,500 bill if you have to replace it.

Mr. YATES. Do they still have electric batteries in Germany that they just slide in and slide out that I was told they had about 10 years ago? They are using them for city deliveries.

Mr. DAVIS. The predominant effort anywhere where electric vehicles are actually operating is the old lead acid battery. That is the major battery that is in play—lead acid.

Mr. YATES. Where are you using the combination that the Admiral talked about—the photovotaics and the battery?

Mr. DAVIS. What has actually happened there is that, particularly in the General Motors case, the predominant influence on their electric car actually flowed out, if you will, of the Photovoltaics Sunrayce program. They were involved in creating an electric vehicle that was actually driven from photovoltaic energy. Since the energy from these available areas of the car was so limited, they made a super lightweight car, but they had very, very limited power needs at that point in time. Then they could provide the power through a battery.

They haven't actually integrated, but I think their plans are to do that. Whatever amount of surface area is on a car, they might use for photovoltaics. That is clearly in their planning.

Mr. YATES. How far away are they if you were to speculate?

Mr. DAVIS. I think it is almost unimaginable what will happen by the turn of the century if we're smart and we're consistent in our programs.

Mr. YATES. How smart are we?

Mr. DAVIS. I think we're getting a lot smarter. I think we're listening better, as the Admiral has said. I think we're listening better both to the American public and the Congress, as the Admiral has indicated.

FUNDING PRIORITIES

Mr. YATES. Do you have enough money to listen better? [Laughter.]

Mr. DAVIS. Well, we're approaching your level of appropriations there.

Mr. YATES. I was delighted to see that you're moving in the right direction. We had put the money in not over your objections, but over OMB's objections, I think, in the past. I'm glad you've taken OMB along now. Are you all the way there? Are you only part of the way there with these increases?

I used to ask Ms. Fitzpatrick this question. Suppose you had the opportunity of using a little more money in some of these programs. Could you use it? Because of the powerful pressure that we imposed on her to come up with these suggestions, she was able to overcome OMB's objections and let us know what addition to the budget might be acceptable.

Admiral WATKINS. I'll answer that, Mr. Chairman. We recognize this is a budget deficit year. It is a tough one for everybody.

Mr. YATES. But this is a very important avenue of attacking not only the energy problem but the smog and the pollution problem.

Admiral WATKINS. But we have incredible demands for reactor starts at Savannah River, for Rocky Flats, and we have neglected environment safety and health for all of these years. Those are big dollars.

Mr. YATES. I have suspected that this part of your budget is the stepchild. You are going to put all the dough of the Department of Energy into Rocky Flats, into the nuclear—

Admiral WATKINS. I think we're going to do better than that, Mr. Chairman. The 1991 budget is a transitional budget for us——

Mr. YATES. Which is more important? Rocky Flats? Or is this more important?

Admiral WATKINS. I wouldn't want to compare those two.

Mr. YATES. It's like asking a kid, "Who do you like better, your father or your mother?"

Admiral WATKINS. We have gone to a totally new-structured budget process in the Department of Energy in building the 1991 budget. They have prepared, and I have reviewed, items that would have taken us to $19.5 billion, a large number of which are in these areas. That $19.5 billion had to be brought down to $17.5 billion, and that is what has come over to the Hill. Those are hard fights internally, but we believe that we were treated fairly by OMB in the final Presidential decision on negotiating the $17.5 billion.

I think we have provided data to your Committee, if you've asked us to over the years, of what we have. We do have line items in there that were we to have the $19.5 billion request, obviously we could spend the dollars on. I have to play in the same game as the other Cabinet members do, and I think we were treated fairly.

We tried to put our very best foot forward on determining priorities, and we determined them to be in a more level playing field across the Departmental requirements. ~~That~~ is—really what happens to these things, I think, far more than any intent on our part to—for instance, in the oil research area, as you know, we're down about where we requested dollars last year, over $100 million plus, and that is the same dollars we put in last year.

COAL RESEARCH BUDGET

The Congress has invariably pumped us up in four technologies that they consider that we shouldn't let go—magnetohydrodynamics, fuel cells, liquefaction, and other things. This is always a point of debate with us as to whether or not we think those things have the priority that I would otherwise have to offset from other funds in the Department. We have made the determination that they don't rack up under that $2 billion reduction below our desires.

We have scrubbed those desires down from $21.5 billion, which was the initial input to me. I said that I could not go with that, but that I would go fight as hard as I could towards $19.5 billion. They came up with $1 billion more than last year's budget, which is one of the few growth budgets in the entire Federal Government this year.

Mr. YATES. But it's only a small growth.

Admiral WATKINS. We should never have allowed the DOE to be put out for its demise. Why did we ever do that? I don't know why we did that in 1980, and I don't agree with it. I think it was a bad idea, but we have allowed the Department to drift down in FTEs and dollars to an incredibly low level of $15 billion. This Nation can't stand that. We went too far.

Mr. YATES. All right. Let's try to help you.

Admiral WATKINS. Well, we're trying to ramp up, but I have to be a little cautious about thinking that I have greater needs than other people. I'm an advocate, obviously, for my Department, but I think, as I said, I was treated fairly in the $17.5 billion figure. Maybe I can wring a few more dollars out next year and grow again. I'd like to grow by at least another $1 billion if I can next year in FY 1992.

COAL BUDGET

Mr. YATES. Let's look at your subtotal on coal.

Admiral WATKINS. That is what I was referring to. I said oil, but I was referring to the coal budget.

Mr. YATES. $239 million down to $110 million. That doesn't give substance to your argument that you were treated fairly.

Admiral WATKINS. Well, I tried to explain that, Mr. Chairman, by saying that this is the same discussion we had last year. The fiscal year 1990 request was $108 million, and you ramped it up to $275 million in the areas that I mentioned—MHD, Fuel Cells, Liquefaction, and Heat Engines. I'm saying that we have reviewed all of that request.

Mr. YATES. Would you rather put the money in other things than where the Congress put it? You seem to say those four areas that the Congress put money in, they——

Admiral WATKINS. If I have to give up other programs, yes, sir, I would. I would not want to take it out of other programs.

Mr. YATES. Okay. I'm not going to take it out of other programs. I'm trying to find out whether in the other programs you have enough money to move forward towards your new national energy policy. This budget will be in existence when you come out with your new national energy policy. You are going to be subject to the same kind of criticism that President Bush has been subject to on a number of other programs. Here you are coming forward with the most marvelous statements in the world, and no money to back it up with.

Admiral **Watkins**. I don't think that's true, Mr. Chairman. I think we've got more substance in this FY 1991 budget request than you're giving us credit for, and I think we'll have more in FY 1992. I think in FY 1992 you'll see. Maybe we'll have to come back in for reprogramming in 1991. I have no hesitancy to do that. I do believe that we've got the best picture now as the National Energy Strategy emerges. We're trying to take the lessons learned so far. FY 1992 will be much more credible in my opinion. I hope to be able to fight to support additional ramping up in energy because of the very things you mentioned, and I'm going to fight very hard for that.

Mr. **Yates**. Let me ask you a question. Will not technology such as fuel cells and new heat engines and magnetohydrodynamics, if developed, contribute to solving the clean air problem?

Admiral **Watkins**. Yes, sir, they could.

MAGNETOHYDRODYNAMICS

Mr. **Yates**. Particularly magnetohydrodynamics as I understand the process.

Admiral **Watkins**. Mr. Gentile could talk a little bit about the cost.

Mr. **Yates**. Where was Mr. Gentile before? You were in another program? Were you with Bureau of Mines or something?

Mr. **Gentile**. Surface Mining.

Mr. **Yates**. I knew I'd seen you somewhere else. [Laughter.]

How did they rescue you from that? [Laughter.]

You're an old coal man.

Mr. **Gentile**. Yes, sir.

Mr. **Yates**. Magnetohydrodynamics, as I understand it, will clean up coal so that we've got a means of using America's greatest energy source.

Mr. **Gentile**. MHD is unquestionably one of the more interesting long-term opportunities, especially when it comes to efficiency. If we're looking for ultra-high efficiency and generation, MHD is one of the ways of solving that problem. It is also a very high cost endeavor. We have expended a considerable amount of money.

Mr. **Yates**. We have. How much have we invested?

Mr. **Gentile**. About $700 million to date.

Mr. **Yates**. Is that all? I had the impression we had invested about $1.5 billion.

Mr. **Gentile**. I think it is $700 million for our share.

Mr. **Yates**. For our share?

FUNDING FOR VARIOUS TECHNOLOGIES

Mr. **Gentile**. Yes. There is no doubt that it is an interesting technology. The question is: Do we need to fund that technology at this point in time? We are looking at closer term technologies to meet the more pressing needs.

Mr. YATES. Closer term technologies include what?

CONTROL TECHNOLOGY AND COAL PREPARATION

Mr. GENTILE. Well, some of the clean coal technologies, the pressurized fluidized bed, the integrated gasification combined cycle, a lot of the technologies that are pushing the efficiency envelope to about 35 to 38 percent as compared to today's 30 to 33 percent.

Mr. YATES. Well, who decided what OMB would do insofar as putting money in and taking money out? I guess OMB did. Did they do it with your recommendation? How smart were they? For example, I notice that for Control Technology and Coal Preparation, that budget was cut by 42 percent. Was that smart?

Mr. GENTILE. Some of the Coal Preparation and Control Technologies were reaching the end of our programs. On Coal Preparation, in particular, there are some projects that are being completed. The gravimelt project, for example, is coming to an end. Some of the flue gas cleanup—we're wrapping up those projects. Some of those types of things are wrapping up.

Mr. YATES. Well, now if they're coming to an end, are there others that ought to take their place, or should they be extended?

Mr. GENTILE. Most of the work in Coal Preparation and Control Technologies was really geared to some of the closer-in technologies. Some of the further out technologies we're pushing off to a little later time, such as microbial cleanup. We're looking right now at the technologies that we need to phase in during the years 1995 through 2000. We're trying to wrap some of those up.

COAL LIQUEFACTION

Mr. YATES. I noticed the budget for Coal Liquefaction has been cut by 69 percent in spite of the fact that you have a National Research Council report which indicates that pilot scale research on direct liquefaction of coal and pilot processing of oil shale is the top priority for the liquids program.

Mr. GENTILE. Yes, sir.

Mr. YATES. You're moving in the other direction.

Mr. GENTILE. My understanding is that this FY 1991 budget was prepared before the National Academy of Sciences study came out. We are looking at that study as we look at our FY 1992 budget.

Mr. YATES. Should you have money in there, do you think?

Mr. GENTILE. You know, we have had major successes in coal liquefaction, there is no doubt. In the 1970s, coal liquids were running about $70 a barrel. Today they are down to about $35 a barrel. That is the result of the work we have done. The National Academy of Sciences said that we should really be targeting at the $25 to $30 range. As I said, we will be looking at that in the FY 1992 budget.

Mr. YATES. Why didn't you look at it for the 1991 budget?

Mr. GENTILE. When the FY 1991 budget was prepared, we did not have the National Academy of Sciences, National Research Council report.

Mr. **Yates**. But the 1991 budget hasn't been completed yet. It has still got to go through Congress.

Mr. **Gentile**. Yes, sir. In terms of the way the budget was prepared, we did not have that study. We are currently looking at the——

Mr. **Yates**. The question we ask is whether or not it makes sense for this Committee, in view of the report of NRC, to put some money back in the budget for the program.

Mr. **Gentile**. Again, Mr. Chairman, I think those decisions, in terms of the Department, were made given the priorities and given the dollars available. This was not a priority at the time the budget was developed.

Mr. **Yates**. Okay.

Admiral **Watkins**. Why don't we do——

Mr. **Yates**. I thought we went over this. You just repeated what you said before.

Admiral **Watkins**. Mr. Chairman, may I just interject? What we may do is take the NRC report and give you a letter from me to you that tells you what our intentions are in the FY 1992 budget now. This will give us a feel for adjustments in FY 1991 that might make some sense.

PROGRAM PRIORITIES

Mr. **Yates**. If the Committee were to put in money for this program, are you telling me that you couldn't use it in 1991?

Admiral **Watkins**. Of course we could use it in FY 1991. The thing that I think Secretary Gentile is worried about is that the dollars are going to migrate out of his other accounts.

Mr. **Yates**. Are you going to do that? Are you going to take the money away from him?

Admiral **Watkins**. No, sir. I'm not taking any money away.

Mr. **Yates**. Well, I'm not going to take it away from him. Who is going to take it away from him?

Admiral **Watkins**. The dollars have to come from some source. Whatever you do on the budget resolutions and everything, the funding has to come from some other source. It's difficult for me to sit here and say that this is more important than all other Federal spending. It is hard for me to say, "Yes, we should have the dollars." I'll tell you this: we could use the dollars up to $19.5 billion that we went to OMB with. I can't sit here and tell you that my $2 billion over the $17.5 billion I was given are higher priority than anybody else's in the Government.

Mr. **Yates**. As I indicated before, we would appreciate your furnishing us with a list of priorities that you think would advance the best energy interests of this country. I would think that if we have moved through the process of coal liquefaction from a price per barrel of $75——

Mr. **Gentile**. $70.

Mr. **Yates**. From $75 down to $35. You're making significant——

Mr. **Gentile**. The first $35 was the easiest. The last $10——

Mr. **Yates**. I would guess that was true, but you'll never get there if you don't keep the program going. Do you think this is better than magnetohydrodynamics?

Mr. **Gentile**. Mr. Chairman, I think that each has its own niche. We're looking here at transportation fuels, and in MHD we're looking at high efficiency power generation. It is the choice between your mother and your father.

Mr. **Yates**. I'm not going to ask you to make that choice. [Laughter.]

What if the Committee were to put last year's levels in?

Admiral **Watkins**. You always have, Mr. Chairman. [Laughter.] It worked out just fine.

Mr. **Yates**. Okay. Usually I have less of a wrestling match. Okay. Let's move on.

[The information follows:]

FY 1991 PRIORITY LISTING

The following priority listing represents the DOE priorities (with adjustments) that were developed in June, 1989. The Department reserves the right to revise the priorities to reflect programmatic changes, national energy needs, etc., as they occur.

RANK	FUNDING ($000)	DESCRIPTION
		Priority 1 - Increase the utilization of domestic coals in an environmentally benign manner and the availability of domestic oil supplies.
	202,309	FY 1991 Congressional Request
1	6,644	Headquarters Program Direction
2	31,099	ETC Program Direction
3	6,624	CT&CP -- Coal Preparation
4	3,397	CT&CP -- Flue Gas Cleanup
5	3,497	CT&CP -- Gas Stream Cleanup
6	1,013	CT&CP -- Waste Management
7	841	CT&CP -- Advanced Research
8	1,197	AR&TD -- Coal Utilization Science
9	225	AR&TD -- Tech. Crosscut/Environmental Activities
10	214	AR&TD -- Tech. Crosscut/Technical & Econ. Analyses
11	694	Combustion Systems -- AFB Combustion
12	4,392	Combustion Systems -- PFB Combustion
13	2,091	Combustion Systems -- Advanced Combustion Technology
14	1,919	Combustion Systems -- Alternative Fuels Utilization
15	1,341	Combustion Systems -- Advanced Research
16	3,062	Surface Coal Gasification -- Systems for Power Production
17	3,520	AE&PT -- Geoscience and Extraction Research
18	300	AE&PT -- University Geoscience Research
19	3,198	Surface Coal Gasification -- Systems for Coproducts Prod.
20	2,244	Enhanced Oil Recovery -- Light Oil
21	1,364	Enhanced Oil Recovery -- Heavy Oil
		Priority 2 - Fundamental research and other Acid Rain related programs.
22	2,550	AR&TD -- Exploratory Technology Base Research
23	100	AR&TD -- International Program Support
24	193	AR&TD -- Coal Technology Export
25	172	AR&TD -- Instrumentation & Diagnostics
26	135	AR&TD -- Bioprocessing of Coal
27	1,639	AR&TD -- University Coal Research
28	909	AR&TD -- Materials
39	1,545	AR&TD -- Components
30	4,610	Coal Liquefaction -- Advanced Research
31	1,554	Surface Coal Gasification -- Advanced Research
32	12,315	Fuel Cells -- Molten Carbonate Systems
33	8,955	Fuel Cells -- Advanced Concepts
34	6,966	Heat Engines -- Gas Turbines
35	7,991	Heat Engines -- Diesel Engines

BUDGET PRIORITIES - CONSERVATION

The Department of Energy prepared the Conservation and Renewable Energy budget to advance a strong, reasoned program of conservation research, development, and financial assistance. The fiscal year 1991 request is considerably greater than previous requests and in certain areas is even greater than previous appropriations. Consequently, the Department believes that an increase in funding is inappropriate. The Department determined that a $212,591,000 Federal investment would adequately fund the highest priority conservation research, development, and financial assistance efforts, and allocated its request accordingly.

Priority 3 - Coal conversion and other strategically important liquids extraction.

36	5,079	Coal Liquefaction -- Indirect Liquefaction
37	16,863	Coal Liquefaction -- Direct Liquefaction
38	825	Coal Liquefaction -- Support Studies/Engineering Evaluations
39	906	Surface Coal Gasification -- Systems for Synthesis Gas Prod.
40	6,838	Oil Shale -- Oil Shale Technology Base
41	1,380	Oil Shale -- Environmental Mitigation
42	1,727	Plant & Capital Equipment - Equipment
43	3,532	Plant & Capital Equipment - Construction

Priority 4 - Other

44	503	Environmental Restoration (Rock Springs)
45	200	AE&PT -- Arctic and Offshore Research
46	4,140	AE&PT -- Supporting Technology & Environmental Research
47	3	Underground Coal Gasification - Gasification Tech. Development
48	182	Underground Coal Gasification - Environmental & Advanced Res.
49	40,300	MHD
50	606	Unconventional Gas Recovery -- Eastern Gas Shales
51	720	Unconventional Gas Recovery -- Western Tight Gas Sands
52	1,000	Enhanced Oil Recovery -- Tar Sands
53	648	Fuel Cells -- Advanced Research
54	2,000	Fuel Cells -- Phosphoric Acid
	$418,271	FY 1990 Appropriation

DOE-Agriculture relationship which fell into disuse in the early 1980s, which it should not have——

Mr. YATES. Right.

Admiral WATKINS. That was a time when it was very important that we look at long-term things. It is not going to come back alive. This is where the energy strategy hearing is very valuable. Clayton Yeutter and I were both out in Nebraska on this, and we saw things that we would not have learned back in Washington with all of the data we had.

Mr. YATES. What did you learn?

Admiral WATKINS. We learned about the importance of the ETBE and ethanol mixes with gasoline that could enhance the octane rating, cut down the pollutants significantly, and be used without major modifications to the automobile. There were 54 million acres of unused land that we could use to grow hybrid poplars, or we could get all kind of sources of——

Mr. YATES. Are you ready to do that now?

Admiral WATKINS. Well, we're ready to get a program going so that we can come over and talk intelligently about how Agriculture is going to contribute X-thousand megawatts to——

Mr. YATES. What would have to be done? We don't have Agriculture coming before our Committee. We do have a question of alternative fuels, however. What would Department of Energy have to do in order to expedite this?

Admiral WATKINS. I think what we have to do is, in the development of our FY 1992 budget and in concept——

Mr. YATES. Why not 1991?

Admiral WATKINS. Because we're not ready, Mr. Chairman, really. We can't come up with a good solid program.

Mr. YATES. But you and Clayton Yeutter went out there and you saw them doing it.

Admiral WATKINS. Right, but we haven't put a program together, Mr. Chairman. That takes time. To get something over here that has budget quality to it, that you can use. We have to face all of the subsidy issues.

Mr. YATES. What would you have to do?

Admiral WATKINS. Mr. Davis may——

Mr. DAVIS. We've done part of it in our 1991 budget request in our biofuels area.

Mr. YATES. Oh, I see.

Mr. DAVIS. We doubled our request for alternative fuels in the Energy and Water portion dealing with ethanol, so that now we have both methanol and ethanol requested in our 1991 budget at substantially higher levels.

Mr. YATES. What will this do to pollutants? If the country starts moving in this direction, will it affect the reduction in pollutants?

Mr. DAVIS. Yes, it will. Without question, it will. In other words, how do you take whatever feedstock you've got and convert it to fuel? The Department of Energy will take the lead on the conversion work. The Department of Agriculture will take the lead on the feedstock work. We think that makes sense. We are both doing what we know best. We need a sustained effort. We have introduced that in our 1991 budget, to bring the research and technolo-

ALTERNATIVE FUELS

Mr. **Yates**. We started to talk about alternative fuels. California and Los Angeles are active in alternative fuels now?

Admiral **Watkins**. Yes, sir, very active.

Mr. **Yates**. What about Denver?

Admiral **Watkins**. Denver is, too, as far as I know. Is that right, Mr. Davis?

Mr. **Davis**. Yes, sir. They are from the standpoint of oxygen content in fuels directed towards carbon monoxide emissions.

Mr. **Yates**. Can you tell me whether what I read in the newspaper is accurate? I was told that the aromatics in building the octane content in gasoline are really not necessary; that it is a matter of profit for the oil companies and that the smog problem can be helped in great measure if you don't use the aromatics. Can you tell me whether that is true or not?

Mr. **Davis**. I can speak to the issue of getting octane. There are other ways to get octane.

Mr. **Yates**. Oh?

Mr. **Davis**. Those ways need to compete. Maybe some of that is alternative fuel or ethanol, methanol, or the ethers. Those are possibilities. Those products with the right kind of supporting research, I think, can be made available to the whole refining industry, and they can select those as a way of providing octane. The information available to us today suggests that those are better ways to obtain the octane from the standpoint of emissions.

But there are implications in terms of what a refinery has to do to be able to use those products that are also substantial.

BIOFUELS

Mr. **Yates**. What progress are we making in alternative fuels? I keep seeing Archer, Daniels Midland every Sunday morning telling me that corn is the way to the future for fuel for automobiles. How true is that?

Mr. **Davis**. Well, under the Admiral's leadership——

Mr. **Yates**. I would think you're under a farmer's leadership.

Mr. **Davis**. I think we've taken an important step there. We have worked directly with the Department of Agriculture and gotten an agreement that there are a number of feedstocks that can serve those purposes in addition to corn. We did not want to get involved with the food versus fuel issue. If corn is not needed as food, you bet it is a good feedstock. Indeed, there is a substantial amount of land held out of productivity at a real cost to us that we believe can be put in production and can support what I would simply say are new product lines for the farmers. I think a lot of the farm industry is beginning to think that way.

Admiral **Watkins**. We think it is one of the most important sources of near-term energy for the Nation.

Mr. **Yates**. Can we exist without a subsidy?

Admiral **Watkins**. You have it now for ethanol. It has a sunset clause on it, I think, of 1991 to be addressed. It will be addressed in our energy strategy because we feel very strongly that the ethanol-based ether ETBE should play a role, not necessarily from corn. We have 54 million acres of unused land out there. We think the

Mr. YATES. Is the Agriculture budget going to contain appropriations for this purpose, do you know?

Mr. DAVIS. We certainly are trying to help them define within their budget——

Admiral WATKINS. It is, Mr. Chairman.

Mr. YATES. Have we talked to Mr. Whitten about this?

Admiral WATKINS. I don't know the 1991 budget dollars, but I do know that in the energy strategy we have agreement, and we are going to move in parallel on it. We can't move unilaterally. We have to have Agriculture's support. We have now cemented that bond with an MOU between Mr. Yeutter and myself, so we're going to be together now, again, where we should have been over these many years. We once had a very good working relationship with the Department of Agriculture in the 1970s, and we dropped it for whatever reason. We shouldn't have.

COMPETITIVE FUEL PRODUCTION

Mr. YATES. Mr. Regula raises this very important point about the extra cost. How are we going to get that down so it is competitive?

Mr. DAVIS. Well, right now, with the subsidies we've got——

Mr. YATES. I know about the subsidies.

Mr. DAVIS. Okay. As I suggested, two things need to be done. We believe we can lower the cost of feedstock. We also believe that we can lower the cost of conversion. In fact, I'd say on the conversion work we have the science in the laboratory to convert wood to alcohol at rates we believe will be competitive. The question is: Can we get it out of the laboratory? Can we transfer from that research accomplishment the kind of industrial process at the volume in the right areas of the country that will actually provide liquid fuels?

Mr. YATES. Which company will be doing that? Do you know? Are there other chemical companies? Who would be taking this up?

Mr. DAVIS. We believe—and I've taken it at least as an individual objective we can get chemical companies, and possibly oil companies, involved because the conversion work happens to be largely chemical engineering.

Mr. YATES. Sure.

Mr. DAVIS. We think if we, again, have the right relationship with industry, it is not a threat. We are not overpromising what can be done here. It is the kind of diversification that chemical companies and oil companies need to look for in the future just like anybody else.

Mr. YATES. But is it to their interest to do that? They have all this huge investment in their oil drilling and in their stations that are distributing their petroleum products. What persuades you that they are going to make this transition?

Mr. DAVIS. Well, for instance, we can take both ethanol and methanol and convert those with byproducts that are currently available as you produce natural gas. We convert those to ethers, and those ethers can go right into the pipeline. Those ethers can be handled within the existing infrastructure and actually get you a better fuel. You might want to call it reformulated gasoline, and that's fine. These are the kinds of market entry opportunities for gy development together with the incentives that eventually we'll ramp down.

Mr. REGULA. Will you yield?

Mr. YATES. Sure.

BIOFUELS CONVERSION COSTS

Mr. REGULA. What's the BTU cost today of ethanol as compared to conventional gasoline?

Mr. DAVIS. Just on a straight BTU basis, ethanol would be a premium of about $1 a gallon.

Mr. REGULA. That makes it difficult though, doesn't it, because who is going to pay that dollar? Not the customer.

Mr. DAVIS. We're not asking people to do that today.

Mr. REGULA. No, I understand you're not, but I'm just talking about it in theory because that is what you hear. People say, "Well, why don't we use a lot more ethanol." We see advertising, yet I think the answer is that it is a buck a gallon more in terms of——

Mr. YATES. Why is it a buck a gallon more?

Mr. DAVIS. Just in terms of the cost right now to produce it. There is a certain cost for the feedstock. There is a certain cost for the conversion work.

Mr. YATES. Is there a higher cost for the feedstock than there is for basic petroleum? For oil?

Mr. DAVIS. If all we had was just a feedstock cost to compare to a gallon of finished gasoline, they'd be very comparable. We've got to get the feed stock cut just about in half, and we've got to get——

Mr. REGULA. You mean the price for a bushel of corn cut in half?

Mr. DAVIS. No, sir. We're looking at other feedstocks than corn now.

Mr. YATES. Which ones are you looking at? You've mentioned that you're looking at other ones. Give us an example of what other ones.

Mr. DAVIS. We're looking at some of the fast-growing trees, where you can harvest year after year after year on land that you would not use to plant corn.

Mr. YATES. You're talking about the South primarily now, aren't you?

Mr. DAVIS. No, sir. There is a substantial area around the country where we have looked at these. There is actually opportunity in the Northwest.

Mr. REGULA. Which trees?

Mr. DAVIS. Poplar is one of the trees that will grow almost universally. We're looking at some grasses. We're looking at some other grains than corn that are possibilities.

COOPERATION WITH USDA

Mr. YATES. Who is doing this research for you?

Mr. DAVIS. We have actually been doing it at a very low level because, as the Admiral indicated, the Department of Agriculture basically backed out of the feedstock work. So the Department of Energy picked that up and has tried to maintain it. Now we'd like to see that expanded. We've clearly sent that signal in our 1991 budget.

alcohols and ethers that we believe are consistent with the oil industry gradually and knowingly moving to better products.

PRODUCTION OF ALTERNATIVE FUELS

Mr. YATES. Is this the sort of thing that companies like Dow or Dupont could go for?

Mr. DAVIS. They certainly could.

Mr. YATES. They're the only ones big enough to be able to——

Mr. DAVIS. Actually, the leading edge right now is the small entrepreneur—the innovator. Some of the small companies that believe they understand how to do this conversion work actually have——

Mr. YATES. Are these chemical companies?

Mr. DAVIS. Largely chemical engineers. That is the background.

Mr. YATES. Give us an example of the type of company you're talking about.

Mr. DAVIS. American Eagle Fuels, which is a very small company based in Nebraska that has a substantial knowledge of both grain milling and processing and all kinds of ethanol conversion processes.

Admiral WATKINS. What we have to do, Mr. Chairman, between now and the time we've put our energy strategy to bed at the end of this year is to put this program together so we can show you that there is a transition and that the research to the application makes some sense. We are not in a position to do that yet. This is a concept that makes a lot of sense, and we all believe that technologically it can be done without great risk, and we need to formulate programs to do it.

Mr. YATES. Are we at the point where the addition of some extra funds will help expedite things?

Mr. DAVIS. Given the amount of work we've got to do to bring it into focus, and the amount of real increases that we requested in 1991, I believe we are right where we need to be. There is a process and a logic now available for us in the Department to make a real good case here. We'll have our day in court. We'll be able to bring that forward in our 1992 budget proposal, and I think that is about the right time. I think we're okay on alternative fuels; as well as coming up with new budget numbers, we've got to come up with new industrial support.

We've got to be sure that there are real companies out there that agree with doing this work. I think we're making some real progress there. I'd refer back to General Motors. They, as well, would very much like to look not just at the tailpipe all of the time, but they would like to look more carefully at alternative fuels.

Mr. YATES. Mr. Regula?

Mr. REGULA. Yes. I was interested when you said you reduced the feedstock cost by half. I assume that you reached that conclusions by saying alternative feedstocks, not necessarily that you're going to get a bushel of corn for half the price it is today, but rather if it is grasses, or wood fibers, or so on they might be, in terms of a BTU basis, half as costly as grains.

Mr. DAVIS. That's correct.

Mr. REGULA. Is that where you're coming from?

Mr. DAVIS. In terms of the amount of energy and fertilizer and everything else you've got to put in to grow them and process them, we think that the real possibility——

Admiral WATKINS. For example, the plan we heard in Nebraska that was presented to us during the hearing indicated that they have in Nebraska at their research centers developed a hybrid poplar that grows at three times the rate of other poplars.

Mr. REGULA. Is that right?

Admiral WATKINS. These are the kinds of things that are getting all kinds of genetic attention right now and are really exciting for the future.

Mr. YATES. Who developed this? The Forest Service?

Admiral WATKINS. I don't know who.

Mr. DAVIS. Some of it has been university research. I think a good portion of it has come from university programs, again, at a very low level.

Mr. YATES. Are these federally subsidized programs that have given birth to these things?

Mr. DAVIS. I would say largely federally sponsored research, yes, sir.

Mr. YATES. What do you see as your main function in alternative fuels? Working with the Department of Agriculture and with the companies in trying to develop a program for expediting the production of it?

Mr. DAVIS. We want to look at both the fuels and the engines that consume them. I think you'll see that we've got efforts on both.

ADVANCED AUTOMOTIVE ENGINES

Mr. YATES. Tell us about the engines that you're developing in accord with General Motors. How much progress are you making?

Mr. DAVIS. I think there has been some good progress with respect to turbines. That is one area where if you can get the temperature of the engine raised—and one way to do that is through ceramic parts—then you can increase their efficiency.

Mr. YATES. Getting back to what the Admiral said earlier, this, of course, according to earlier hearings that we've had is a tremendous source of competition we have with Japan.

Mr. DAVIS. That's correct.

Mr. YATES. Who is going to come out with the best opportunity? Are we still ahead of them on that?

Mr. DAVIS. I think we may have some lead in the scientific and technology base.

Mr. YATES. Didn't I criticize Mr. Darman for cutting this program?

Mr. DAVIS. I'd actually like to get to that point.

Mr. YATES. Go ahead.

Mr. DAVIS. We have two contractors currently developing turbines. We've spent about $240 million to this point in time.

Mr. YATES. Right.

Mr. DAVIS. The level of cost share for those two teams has been about 10 percent. The issue really, or the key to the gas turbines, is ceramic parts. I think our objectives and your objectives are exactly together. The process here is important because the issue really is materials. For instance, Argonne is involved in high-temperature superconductivity and materials. They have a very successful program. It is a 50/50 cost share. Actually, 51/49 where industry is bringing that level of cost share.

So we're not objecting to the technology or even what we're trying to accomplish. We're saying from a management point of view we believe that if DOE is allowed to, we can probably get the same amount of results if we just are in a stronger management position and encourage a little bit greater cost share from these teams. The teams are probably in a position to do that.

Mr. YATES. Which teams?

Mr. DAVIS. The two teams right now, Allison and Garrett, that are working on automotive gas turbines.

Mr. YATES. And they just got up to this point and only contributed 10 percent?

Mr. DAVIS. It is roughly 10 percent. That number is going up.

Mr. YATES. What is your dealing with Argonne?

Mr. DAVIS. Well, I was only using that as an example where they're involved in the high-temperature superconductivity which is, again, materials work.

Mr. YATES. But who is hiring them for that? Who is paying them to conduct that kind of research? Are you doing that?

Mr. DAVIS. Yes, sir. We are doing that, and we provide about 50 percent of the funds, and industry directly provides 50 percent of the funds.

Mr. YATES. But you're managing the——

Mr. DAVIS. Yes, sir. There are three centers. One at Argonne, one at Oak Ridge, and one at Los Alamos.

Mr. YATES. Is there a reduction in this program in this budget?

Mr. DAVIS. There is a reduction on the automotive gas turbine, and that reduction would allow us to proceed with one team.

Mr. YATES. I thought so. I accused Mr. Darman of contributing to the best interest of Japan when he appeared before our Full Committee. This is an important program and one which the Committee is particularly interested in. Do you want to go back to last year's budget figure?

Mr. DAVIS. Excuse me?

Mr. YATES. Is this a program to which you should return to last year's budget?

Mr. DAVIS. Sir, again, we are trying to make a clear statement that we agree with the objective. We think in a stronger management position we can accomplish exactly what the objectives are at less funding.

Mr. YATES. Suppose you had more money? Would you be better off?

Mr. DAVIS. We still might change the focus a little to be on the ceramics which is really what the issue is.

Mr. YATES. Yes.

CERAMICS

Mr. **Davis**. If you look across our programs in general, we've got $25 million that we are trying to spend wisely in the whole ceramics area. I think if you look at ceramics as a topic, that is an area that we're going to look at much more carefully in our 1992 presentation.

Mr. **Yates**. I keep hearing about the 1992 presentation for almost every program. Why do you want——

Admiral **Watkins**. We have not put our act together in an energy strategy, Mr. Chairman. I'm sorry to say that. It takes time. We're not ready to roll on a lot of these things. We are starting from scratch and building programs that should have been underway now for 10 years.

Mr. **Yates**. That's right.

Admiral **Watkins**. I'm sorry, but we're doing the best we can in the 1991 budget to do everything that we have got a handle on right now. We are trying to move out in a more aggressive way downstream to, I think, satisfy your own frustrations a bit more than we have in the past. I really do think we are on the same wavelength with you. We are trying to do it within the budget constraints for this year.

Mr. **Yates**. The problem has been that we've had Dr. Edwards in charge of this program before.

Admiral **Watkins**. It's like pulling eye teeth. [Laughter.]

Mr. **Yates**. You know, at that time, I remember how grateful we were to Mrs. Edwards because she liked a refrigerator that saved energy and persuaded her husband to recommend the program. That was the way the energy budgets were formulated in those days, apparently.

Mr. Regula?

SAFETY IN THE NUCLEAR NAVY

Mr. **Regula**. Thank you, Mr. Chairman.

We talked about nuclear earlier, and I'd be curious about, of course, the Navy's experience. You've had many years with the nuclear Navy. Obviously, the sailors on the submarines sleep around those reactors. In your medical evaluations, was there ever any evidence that sailors who served in the nuclear Navy had any greater incidence of cancer or other medical problems in subsequent years as a result of that service as opposed to those who were non-nuclear?

Admiral **Watkins**. To the best of my recollection—and I'm not sure of the data; I'd have to provide that for the record—those in the operating Navy, that is the uniformed sailors who operated those ships but were not exposed to the higher levels of radiation during the extreme maintenance operations in the shipyard, for example, actually received less dose than the average human walking about Washington, D.C. Certainly those at higher altitudes, without any question. That was the data we had then.

[The information follows:]

INCIDENCE OF CANCER AMONG NUCLEAR NAVY PERSONNEL

Based on information provided to me by the Navy, an extensive study of the health of sailors who served aboard U.S. nuclear-powered submarines was completed by Yale University in 1987. This study indicated that the submariner population is a healthier group than their civilian counterparts. No association between ionizing radiation and the incidence of cancer was found.

Admiral **WATKINS**. Employees in the shipyards that had to tear down radioactively-hot plants clearly have a higher dose rate than the average American citizen, and they had a corresponding slight increase, but not significantly so, in the rate of cancers. This the name of the game. We're all in it. They all know it. We control it. It is minimal, in our opinion. In terms of comparison with most other nations, we do a very good job and are very sensitive to it, but it is still there.

Mr. **REGULA**. I think probably the evidence would certainly show in terms of the uniformed sailors that where you have a high degree of safety in the procedures—and this is what Admiral Rickover told me at one point when I asked him the same thing that you're saying—that there is no greater cancer incidence than those who were on non-nuclear submarines which says that in effect if you run the program right, if you have a high degree of safety standards, that you don't have a threat.

Admiral **WATKINS**. You're exactly right. Because we have not made any plant investment as well as not capitalizing on the Three Mile Island lessons, the defense reactors were shut down. So we built up a case against ourselves over these past 10 years which is really totally unnecessary. Many times people say, "Well, you're putting money into plant investment instead of environment." I'm saying, "No, they have to go together."

You have to make the fixes. You have to do all of the plant upgrades. You have to do the latest in technology. You keep those plants moving up in technology. At the same time, you get your operators trained and sensitive to environment, safety and health. We have not done that. This is why we're in the mess we're in now, and we'll be out of it at the end of this year. I think we'll be there pretty much across the board. I said it would take two years, and that is about what it is going to take.

Mr. **REGULA**. Thank you

Mr. **YATES**. Mr. Lowery?

Mr. **LOWERY**. Thank you, Mr. Chairman.

BATTERIES FOR ELECTRIC VEHICLES

Admiral, it is great to have you before the Committee. I want to pursue some of the alternative energy issues, primarily the electric vehicles. I am concerned about the environmental impacts that there may be from electric vehicle batteries. If an electric vehicle had an accident, would the acids in the battery be dangerous to the environment? After the life span of the batteries, how do you intend to safely dispose of them?

Admiral **WATKINS**. Mr. Lowery, I don't have the direct answer to that. I think Mr. Davis probably would have the answer here that he could give you.

Mr. **DAVIS**. If you compare those batteries to basically lead acid batteries, some of the batteries we're talking about have sodium, sulphur, zinc, bromine, and lithium. I would say at this point in time that we don't see substantial risk or change beyond what we're already dealing with, so I don't see anything that would suggest the envelope of new battery technology is any more of a concern than existing batteries.

As you know, one of the actual issues in municipal waste management is when batteries get into that system because lead is a substantial problem. I'd like to answer in more detail when we're up here Monday about just what we've done to understand the new chemicals or the other chemicals in batteries and how that compares. I don't see anything that would be necessarily worse for the environment than what our concern about lead is today.

Mr. LOWERY. What about impacts? Sure, we've got electric batteries around but not necessarily a high volume of vehicles where you have this tremendous trauma. Does that pose any kind of a problem?

Mr. DAVIS. I would say at this point in time our information on that is probably incomplete. Most of the effort has been to look at battery pairs that could actually begin to deliver the kind of energy that you need at a cost. Some of these other issues have not probably received as much attention as they might.

Mr. LOWERY. Let's get into funding for a second. I notice your 54 percent decrease, $3.6 million for electric battery. What is the reason behind the cut? As I understand it, you're going to cut to three batteries. Is that correct?

Mr. DAVIS. That is correct.

Mr. LOWERY. And that you expect to make more progress. I don't understand how you would increase concentration when you were basically provided the same funding for those three last year.

Mr. DAVIS. The funding that we've actually requested for those three is, in fact, similar. It is just slightly more than what we spent last year. The message we are trying to convey is that we believe we need to put whatever resources are available to us into a smaller set of——

Mr. LOWERY. You're cutting from how many batteries down to three?

Mr. DAVIS. There are somewhere between 7 and 11, depending on which group you talk to, down to 3.

Mr. LOWERY. And you believe these are the three most promising technologies?

Mr. DAVIS. We believe they offer the best combination of power density, cost, lifetime, and chargeability.

Mr. LOWERY. Okay. Focusing on these three, we can accomplish the goal sooner and at far greater cost efficiency?

Mr. DAVIS. That is our expectation.

Mr. LOWERY. Okay. I'm not prepared to quarrel with that. I guess my question is if you're going to trim back some 54 percent because you see these three as the most promising, why not pump more resources into those three that are left as opposed to leaving——

Mr. DAVIS. Well, maybe we have created a good target.

Mr. YATES. For the 1992 budget, they will. [Laughter.]

Mr. LOWERY. Sometime off in the future. This is what we've been hearing in the Department of Defense for years and years. It is always better in the outyears. What about the year now?

Mr. DAVIS. I actually will stand behind our choices as to——

Mr. LOWERY. I'm not quarreling with that because I'm not prepared to. You haven't put any additional resources in. Is the belief that by focusing on these three we can bring fruition faster?

TRANSPORTATION SECTOR

Mr. DAVIS. There is a larger question that I think we all have to address. We tried to look at the transportation. We think that if we're going to make the right investments we got to look at the transportation sector. When we go to transportation, we've got to look at the supply issues which are alternative fuels that we talked about. We've also got to look at demand reduction issues, which are the efficiency sorts of things we are talking about. You also have to look at the infrastructure. What kind of investments can you make there that make sense?

Then you get to various supply options. One of them happens to be electric vehicles, and that is a subset of a number of other investments that we've got to think about in terms of what is the soonest impact we can make on urban air quality relative to transportation systems and fuel. I would say that we made a legitimate effort to shed light on that whole set of questions. We got to the point in our 1991 budget that you see. It does represent some choices. It does represent some focus. There is a better logic to it. The logic is certainly more consistent with the signals that you've sent for a number of years. I don't think we're waiting until 1992; I think we've made substantial progress in 1991. Clearly, there are opportunities, and we're starting to see those opportunities better as we put together this framework for looking at transportation by both supply and demand.

Mr. LOWERY. Well, for non-attainment areas, specifically urban areas across the country, particularly for delivery purposes, it strikes me that electric vehicles make an awful lot of sense. The sooner that we can bring them on line the better. Obviously, the key is the range and the storage capacity of batteries. I don't know why we're trimming this program—and that's in essence what the bottom line is. We're not refocusing those resources into those promising technologies; we're leaving them standing. It strikes me as a major mistake.

VEHICLE DEMONSTRATIONS

Just one final question. On the site operators users task force, what is the status of the task force? Where are we headed?

Mr. DAVIS. We're actually expanding that task force. We have a couple of new participants in the task force. We're now in the process of transferring funds to GSA to begin the acquisition of alternative fueled vehicles so that we can get on with that work. We have added to our budget request in that area also an accompanying initiative to deal with data.

We think one of the things we've got to do right along with these demonstrations is make sure that we get good performance data that looks at both performance and emissions, the engines that are being used, and the fuel that is being used. Right now, the data you'd actually use to move these programs forward is really difficult to use.

Mr. LOWERY. That's it.

Mr. YATES. Mr. Regula?

Mr. REGULA. Thank you, Mr. Chairman.

DEMAND FOR IMPORTED OIL

Admiral, you mentioned about potentially getting to the point where 60 percent of our oil as imported. Am I correct that that is what you anticipate might happen?

Admiral WATKINS. The Energy Information Agency has projected that it could reach and/or exceed 60 percent by the year 2000.

Mr. REGULA. How do you react to the fact that the Clean Air Act is really going to drive our utility industry to consuming more hydrocarbons, particularly oil and also gas, in face of the fact that without that impetus inparts are still going to hit 60 percent and could be much worse as a result of the passage of the Clean Air Act in its present form?

Admiral WATKINS. Well, there is some indication, Mr. Regula, that there will also be significant pressures on conservation efficiencies that could help dampen that continued appetite for oil in the transportation sector. I think the estimates that I'm giving you are based on the best integrated look at this point in time with some expectation of what might come out of Congress on the Clean Air bill.

All of the things we talked about are absolutely essential for the long haul, but we're not going to see that turn over that soon. It doesn't have that kind of response time when you're talking about the number of vehicles. Unless we take a dip in the national standard of living, or unless we have some kind of mandate to get rid of old cars, or something like that, it isn't going to happen much faster than what I'm telling you about. I do think it is possible with a real concerted effort on alternative fuel.

I think with the kinds of things that we have been talking about here this morning that we can begin to see some bending over of that growth curve again back and then begin to come down in the first decade of the next century. I think it is going to take that long to do it.

Mr. REGULA. Shouldn't our emphasis as far as the production of electricity—and obviously the consumption of that is going to grow at a rapid rate based on the empirical data——

Admiral WATKINS. It is very serious, and we do not have the margin to cover 60 percent of the anticipated growth at 2.5 percent of real gross national product growth over this decade. We don't have the sources for 60 percent identified. We don't know where—

Mr. REGULA. In electric——

Admiral WATKINS. In electric generation, right. We could talk about electric vehicles and everything, but somebody has to still supply electricity. Photovoltaics may offset some of the need for generating electricity, but nevertheless we are a long way from all of that yet in terms of real impact nationally. We have a lot of work to do, and all of the effort we're doing now, I believe, is effort that should have gone on for the last 10 years. We're letting ourself get in an extreme situation, and then we're driven to something like we've been talking about here today—inadequate resources devoted to this. Now it is more expensive to do it than it would have been had we started all this kind of thing some time ago. We could have weaned ourselves away, perhaps, from excesses, but we still could have kept some of these things very much alive and very aggressively pursued them because we knew the outcome even back in 1980. There was no question about it.

EMPHASIS ON COAL RESOURCES

Mr. **Regula**. Given that obvious need that you are describing, given the fact that in today's world nuclear is not a viable option because of public sentiment, and given the fact that we're headed to the 60 or greater percentage of imported oil, wouldn't it seem that in terms of national policy we should put a lot of emphasis on coal since we have an enormous resource? And, therefore, as a followup to that, clean coal technology which allows us to burn coal in an environmentally safe way?

Admiral **Watkins**. No question about it. I don't think there is anything that we have heard to date across the Nation that doesn't say it's going to be our prime contributor to the national good in the foreseeable future. We've got somewhere between 300 and 400 years of coal supply. We've got a Clean Coal Technology Program, which is an aggressive program, and which we don't want to have any interference with right now because we believe in the long term that after the turn of the century when the first three power plants get on line, we will be seeing not only decreased SO_2 and NOx generation, but more importantly we will see increased efficiency. We believe that will generate less CO_2 by anywhere between 20 and 40 percent.

Coal is not only good for us, but it is good for the world. We have emerging Third World nations who are going to have to have help with this technology, and come on line with their economies without ruining their environment, as they have done in Eastern Europe. It is a pathetic story. Coal is a very substantive part of the current National Energy Strategy and will be for the long haul. We've got to keep that in mind as we encourage and incentivize the utilities out there to come onboard on the Clean Coal Technology Program, and we cannot have disincentives for that. I fought that through the whole Clean Air bill process, and I want to continue to fight that way because I feel very strongly about it. We know that now. Our energy strategy hearings support all of that.

There are many who say you can't generate all of that CO_2 because of a global climate change. My feeling is that you have to balance that off. We have to find the balance between the rising and competing interests, and I think we will find that as we develop our final report to the President.

Mr. **Regula**. Well, one of the messages of Earth Day clearly was—and I was interested that 140 countries reportedly participated—that in talking about environment, you're talking about a global strategy. I think what I hear you say is that a part of our global strategy, given the fact that the Chinese have enormous coal reserves, that these Third World countries have coal reserves——

Admiral WATKINS. Also India.

Mr. REGULA. Therefore, they are going to need our technology if they're not going to pollute the global environment.

TECHNOLOGY TRANSFER

Admiral WATKINS. That is exactly right. I would hope that we would be able in our technology transfer emphasis in this decade to be able to also have "Built in USA" on that technology in terms of equipment when it gets transferred, so that we have some help. If we don't change our ways of doing business in transfering technology, then we will be behind the eight ball again, and we will see "Made Offshore" on every piece of equipment that goes over to emerging Third World nations. This will be a disgrace for our country that is supposed to be so technologically competent.

You're going to see us really fight hard for this because we feel so strongly. This not only gives us the national economic strength but the ability to export offshore American-made products that are very important to the world right now. I would say in this whole area of coal that we need to put every bit of effort we possibly can into it.

CLEAN COAL TECHNOLOGY

Mr. REGULA. That leads me to two things. One is on clean coal technology, I believe given the Clean Air Act in its present form—and certainly the timelines would be unlikely to improve as far as clean coal—there is a real sense of urgency about getting these programs moving, particularly Rounds 4 and 5.

I'm making this statement, and we'll probably discuss it at another point. I don't think that we ought to disturb the formula that has worked so effectively on Rounds 1, 2, and 3 because if there is any way at all that we could accelerate clean coal development so that it could meet the timelines that are obviously going to be part of the Clean Air Act, we would be doing a great service. Would you agree that there is a sense of urgency to getting that technology moving?

Admiral WATKINS. There is a sense of urgency, and we have a number of things that I referred to in my statement. The WEPCO decision is one of them. We have already had several coal utilities drop off the line because of the threat of being hammered by the regulatory bodies on any kind of repowering of their plants, or retrofit, that could be considered to be requiring a new source performance review. We have to eliminate that. I think it will do great damage as the Bill is currently constructed it unless we clarify very clearly to the American industry that there is no nonsense about this. If they improve for the long haul—this is in the best interest of the Nation—they will not be penalized in a new source performance review. We must clean it up.

It was the initial intent of the President in our so-called fact sheet before the bill was actually prepared, it was in the bill initially when it came over to the Hill, and it has been toyed with. There has even been some disagreement even within the administration staff—not the President and not me—but there have been other people toying with that thing and playing around with the WEPCO decision. I can tell you it is a very big detriment right now. Certainly, offsetting the cleanup of existing power plants with $1.3 billion of Rounds 4 and 5 and unobligated balances from the first three rounds will do irreparable damage. In fact, I think it will kill the program.

Mr. **Regula**. Well, I hope that in your approach to Rounds 4 and 5 that you will stay with the formula that has worked well and build in in every possible way the sense of urgency that I think needs to be part of that program.

Admiral **Watkins**. Well, as I mentioned to the Chairman, Mr. Regula, I do want to sit down with you and the Chairman and talk about the repayment aspect. I think that is the only thing left in contest. Round 3 actually was, in my opinion, better executed than Rounds 1 and 2.

We have now got some acceleration and, as you know, I'm going to get all Round 3 cleaned up this year. Round 2 will be cleaned up by this summer—by June. We have been too slow in that. We now have parallel processes going, so we can expedite the requests coming in in response to proposals. I think we are on track there.

Mr. **Regula**. Did DOE convey to Energy and Commerce their concern about the Sharp amendment because of the debilitating impact it would have on the availability of funding for Rounds 4 and 5?

Admiral **Watkins**. It probably came too late. It came at the eleventh hour, and it was there before the final decision but it could have come earlier. I blame myself a little bit for that because I wasn't on it on a day-to-day basis. We were a little bit surprised, frankly, by the Sharp amendment. I think we were caught off guard by that. Perhaps we shouldn't have been. It is hard to move the process in the bureaucracy through the various wickets we have to go through and respond very quickly.

Because it is an element of the Clean Air Bill, and due to some prior negotiations in the Senate, and commencing in negotiation by the Administration and by the House—I'm not the spokesman for that I had to work through the system. We were slow getting it over here. We had hoped it would be here in time, but it was here at the eleventh hour. As I say, it didn't have the impact. We certainly fought it hard over on the Senate side, and I would hope some of that word would have leaked over on this side to help out. You have our commitment to fight very hard on this issue, and I hope you would help us in this.

SOUTHWESTERN PUBLIC SERVICE COMPANY

Mr. **Regula**. Absolutely. I appreciate that.

Another topic—Southwestern Public Service Company. As I understand it, one of the projects selected in Round 2 proposed by Southwestern Public Service would convert a gas-fired power plant to a coal-fired power plant. That certainly fits with what we're talking about here in using our coal resources. This project has met with some opposition from a few groups with respect to the increased emissions caused by converting from gas to coal. As I understand it, in reality the emissions from this project would be considerably below the standards mandated for phase 2 in the proposed Clean Air Act. Is that an accurate statement?

Admiral **Watkins**. Let me say this, Mr. Regula, about that particular one. As you know, we went out with a NEPA finding based on an environmental assessment of no significant impact. This is the real issue regarding that particular activity. The comments coming back, and my personal view along with the General Counsel and many others in the Department, clearly indicated to us that that plant would either be stopped by those that feel that we were clearly in violation of NEPA, or we would probably be at odds with the Southwest Public Service Company because they were misled, perhaps, that they got into this game and nobody really gave them a straight shot at an EIS.

There is no question in my mind that an EIS today is necessary unless there is a specific waiver that says that this is in the long-range best interest of the Nation to convert this now and make it a clean coal, gas-fired unit. If we get that kind of a waiver, I would applaud it. The near-term rules and the law are very clear, and what we're doing is putting more pollutants out. Without any question, we're violating all of the rules under NEPA.

I believe that an EIS is required. I don't like that solution because I think it is not in the long-term best interest. This is more or less an experimental thing to move us into commercialization with technologies. We have to also comply with the law. I can't have it both ways.

I am trying to comply with NEPA law in the strict sense. Strict construction is going right down the line. We have been hammered or for too many years. We've been losing everything and every court case. I'm tired of it, and I'm afraid we might lose this one, too. We tried to explain that to the Southwest Public Service Company. I understand their frustration on this. I wasn't around when we were talking about this initially, but we have to face the music on it. I hope that they would stay with us on it or that they would get some kind of a waiver. For this purpose, we ought to be able to let them off the hook.

Mr. **Regula**. Who would give them the waiver? EPA?

Admiral **Watkins**. Well, EPA would have to, but I'd question whether that is going to be possible. Bob, you've been in—I think EPA has permitted the project.

Mr. **Gentile**. EPA has permitted the project but since it is a DOE action, it is a NEPA action, and DOE has to act on it. Therefore, we're held up to the requirement that if there is any significant impact, we have to make the decision.

Mr. **Regula**. What if they were to build it with their own funding? Would they still have an EIS requirement?

Mr. **Gentile**. No. Because it is a Federal project, Federal dollars, the Federal Government is held to the NEPA.

Mr. **Regula**. Certainly, in the interest of the country if you can convert from a gas-fired plant and preserve that clean fuel for many other applications, looking at a 100-year timeframe, it makes sense, I would think, to use the coal as opposed to using gas to produce electricity.

Admiral **Watkins**. Clearly, Mr. Regula, as you know, we are moving back in the direction that was opposite that which was proscribed by law years ago to put gas into baseload electric generation. We are seeing that now, so I agree with you that it would be very appropriate for them to shift to the new technology in coal, recognizing that they are going to put more pollutants into the air under NEPA than they would with a gas-fired plant. We are going to have plenty of gas-fired plants. We know that is cleaner in many ways. This is an attempt, I think, by them to participate in the Clean Coal Technology Program effort. I applaud that.

I am just trying to comply with the law. We have lost too many court cases where we haven't been sensitive to the real issues. I'm afraid if we were sued in this case, that we would lose again and then we would stop the project and even have more investment by the Southwest Public Service Company going down the tubes. So we ought to stop it now and regroup and see if there are any provisions that could be imposed here. I don't know if legislative relief is possible on a specific basis like this, but that is another possibility that we ought to work with you on.

STRATEGIC PETROLEUM RESERVE

Mr. **Regula**. The Strategic Petroleum Reserve—have you examined the possibility of leasing oil to put into that and/or trading debt for oil with some of the debtor countries as a source of oil to fill the SPR?

Mr. **Yates**. I wouldn't call Saudi Arabia a debtor country. [Laughter.]

They're looking at Saudi Arabia, I think. Isn't that what I read in the papers?

Admiral **Watkins**. Well, that certainly is one of many, but we have a number now.

Mr. **Yates**. Why would you want to lease instead of buying as we have been doing?

Admiral **Watkins**. It would save money.

Mr. **Yates**. Yes, you save money, but there is a question also of security. You've got it over in Saudi Arabia, and OPEC comes along and gives us another boycott. Then what happens at the rest of——

Mr. **Regula**. What I was thinking of is if we had leased the oil and put it in our SPR with the proviso as to what it would cost us if we were to purchase it so that we would know what the cost would be.

Mr. **Yates**. Why do you want to do it? I know you want to save money. Aren't there other considerations than saving money?

Admiral **Watkins**. Well, Mr. Chairman, you are right. There are other considerations. We have sent a report to Congress at Congressional direction, as you know. On the 2d of February, you received our report over here on the Hill that listed all of the various options that we looked at. I think one of the things that has come out of this is that I don't sense at this point that there is any strategic obstacle. That is, we were worried whether this would be less stabilizing, for example, or whether it would be more stabilizing. We weren't sure.

I think that has come up generally a wash in all of the debates we've heard today, and it really has come down to cost effectiveness. It is a factor to cost reduction, and that seems to be something that we really ought to consider. We believe we are asking for authority over here to engage in some negotiation to see how realistic our expectations will be there. Is there something really worthwhile in the best interest of the Nation? Both nations? Certainly, we would not do anything that was not in our best interest under a set of guidelines, you know, of how we might stage these negotiations, which has been pretty well outlined in our report to you.

Mr. YATES. Mr. Regula asked about Third World countries. Would that same argument be present in the case of Venezuela? Nigeria? or some other place?

Admiral WATKINS. I'll be meeting this week with the oil minister from Venezuela who seems to now have indicated a very strong interest in a leasing mode that I want to listen to and hear about. We are not in a position to negotiate. We haven't gotten the authority from up here. We're asking for that authority.

Mr. YATES. Where would the oil that you lease be? in Venezuela? Would they deliver it? How would it be done?

Admiral WATKINS. Let me ask Secretary Gentile to give us the specifics.

Mr. GENTILE. We would lease the oil. We would put it in our SPR. We would lease the oil, accept the oil, and put it in the SPR. It would be held in the SPR as leased oil, but it would be under our control.

Mr. YATES. As leased oil who would own it? Venezuela?

Mr. GENTILE. If Venezuela were the country we were leasing with, Venezuela would own it. It would be within our SPR and under full control of the President. That would be the condition of the lease.

Mr. YATES. What do they gain by it?

Mr. GENTILE. They gain several things. It depends on the country. They gain the ability to pull the oil out of the ground and put it in a reservoir closer to their markets. It would give them the advantage of having the oil in a very secure spot in the U.S. and eventually, hopefully, get it into the U.S. market.

PEMEX OIL

Mr. YATES. I had the impression that we bought most of our oil from Mexico.

Mr. GENTILE. We had a contract with PEMEX, and we were filling the SPR with PEMEX oil. This is over and above that. That contract has been terminated.

Mr. REGULA. Would not Venezuela have to get some capital investment?

Admiral WATKINS. Mr. Chairman, I wasn't sure if you heard Secretary Gentile inform you that that contract actually terminated with a mutual agreement between Mexico and the United States last fall because of the quality of the crude.

Mr. YATES. Really?

Admiral WATKINS. Yes, sir. We could not——

Mr. **YATES**. It was not sweet or something?

Admiral **WATKINS**. Yes, sir.

Mr. **GENTILE**. Our last purchase, as a matter of fact, was Norwegian sweet. That purchase was recent, I think last week.

Mr. **YATES**. This is what? a foreign policy consideration?

Mr. **GENTILE**. No. From our point of view, sir, it is strictly an economic consideration. We have talked with a series of——

Mr. **YATES**. If you lease, how much money do you save?

Admiral **WATKINS**. About half, sir.

Mr. **YATES**. Really?

Admiral **WATKINS**. Over the life.

Mr. **YATES**. But I don't understand how. Suppose we were to use it. Do we pay for it at that time?

Admiral **WATKINS**. Yes, sir, we do. We pay for it as agreed to in a protocol that has not been negotiated yet.

Mr. **YATES**. At what kind of a price? At the price current at the time that you use it or at the time you lease it?

Mr. **GENTILE**. There are all types of scenarios. One would be that we would negotiate a fixed price at the end of the term of the lease and receive the oil then. We could turn it back, should we not need it. We could build in an escalator or whatever. There is room for negotiation there. The key here is basically to rent the oil, put it in our SPR, pay the carrying charge should we need it, and then we would buy it or return it. If we were leasing and decided we didn't need the oil, we would give it back to the owner who would probably get it out of the SPR and sell it commercially in the U.S.

Mr. **YATES**. Can you put a statement in the record as to what the advantages are pricewise?

Mr. **GENTILE**. Yes, sir.

Mr. **YATES**. I'd appreciate that.

[The information follows:]

SPR LEASING PROPOSAL

The Administration seeks authority to negotiate oil "leasing", or comparable arrangements, with oil suppliers, with the condition that such a contract would be entered into only if it was determined to be cost-effective relative to purchase. The primary advantage of this legislative proposal is that it expands the range of SPR oil acquisition methods to create the potential for cost savings and accelerated fill of the SPR.

Under direct purchases, the U.S. Government acquires both the control over the oil and full equity ownership, with the attendant risk of profit or loss from changes in the value of the oil during storage. The costs are borne immediately at time of delivery.

Under oil "lease" approaches, the Government acquires full control over the oil, thus achieving the basic intent of the SPR program, but not necessarily full ownership. Costs are deferred in the form of annual payments during the term of the lease, creating interest savings for the Government. If leases can be negotiated which are favorable relative to purchase on a present value of life-cycle costs, there is a potential for significant budget savings to the Government, and accelerated fill of the SPR.

Mr. **YATES**. Mr. Lowery? Mr. Regula? Any other questions?

Mr. **REGULA**. One last question. Many of these countries would anticipate as a condition of this kind of a negotiation that there would have to be a flow of capital investment to enhance their production, I would assume, and that they'd come out of the private sector in joint ventures. In any event, I would suspect they would need some substantial infusions of capital in order to have oil beyond their present market demands to put into a lease agreement.

Mr. GENTILE. Well, some of these countries, Congressman, have excess capacity right now, like the Emirates and Kuwait. In the case of Venezuela, since you have interest in Venezuela, Venezuela is looking at drastically increasing their production, and they are looking at doing that with a joint venture, both among Venezuelan and outside interests.

Mr. REGULA. Thank you, Mr. Chairman.

Mr. YATES. Any other questions?

Admiral, thank you very much. We're going to have other questions that we ask you to answer for the record.

Admiral WATKINS. Thank you.

Mr. YATES. Thank you very much for your presentation.

[Questions and answers for the record follow.]

ADDITIONAL COMMITTEE QUESTIONS

Overall Energy Policy

Question: How much effort in dollars and in man years is the National Energy Strategy costing the Government directly and through contractors?

Answer: NES development began in July 1989. Expenditures through April 1990, for analyses, public hearings, and production of the interim report are as follows:

- printing of the NES Interim Report (10,000 copies) - $33,500
- contract support (data and analyses) - $1,192,419
- travel (for public hearings) - $88,152
- federal salaries - $341,000

The cost for salaries is for approximately 5.5 FTEs who were assigned to work on the project as their major or most significant duty during all, or a major portion of the period from July 1989 to April 1990.

Question: Explain what additional modeling is necessary for the Strategy. Why is this the case?

Answer: The essential modeling requirement for the NES is to evaluate the impact of a range of energy policy changes on energy use patterns, emissions, domestic energy supply and national economic performance. Careful measurement of the impacts of specific policy changes cannot always be carried out with existing models, since most of these models seek to portray a most likely energy future based on the extrapolation of current trends. Additional modeling work is needed to see how different Federal and State policies will affect U.S. economic performance, current and project technologies, and energy supply demand, imports and pricing.

Question: Don't almost all current models predict similar outcomes given the same basic assumptions?

Answer: Not all models predict the same outcome from the same assumptions. In addition, models vary greatly in the number of assumptions they can "digest" and in the consequences they can reveal. The reason for dissimilar performance is that models are simplifications of the world. Some models are more severe simplifications than others; likewise, some simplifications are more skillful than others. By intent, some models incorporate richer detail for some sectors of the economy than for others. These choices may be dictated by limits on resources, data, theoretical knowledge, time, or outcomes for which information is needed.

Models designed to address long-term issues cannot be expected to match the results from a short-term model. Also, the data underlying the estimation of a model is critical, i.e. Cross-Sectional vs. Time Series data from different sources will cause the model to perform differently.

Assumptions are often loosely defined as macro or price inputs. The parameters and coefficients of the model are equally important.

Current Policies - Conservation

Question: The Committee is pleased to note, that true to your word, you have convinced the Administration to support conservation activities at levels akin to those supported by the Congress for over a decade. Congress has emphasized research and development, while the initiatives announced by your Deputy Secretary and approved by the Congress in fiscal year 1990 appear to be more oriented to short-term markets. Is it your intent to concentrate more on short-term, less research and development oriented work or on longer-term research and development, which the Congress traditionally has supported.

Answer: The program focus has shifted somewhat away from a strictly long-term, high-risk research and development focus, and now includes a balance of activities that will have impact in the near, mid- and long-term time frame. This is in fact consistent with past Congressional actions. The Administration's budgets of the past decade were focused on long term R&D, and Congressional increases were often targeted to near term technology and product development. We still believe that product development is best left to industry, but in R&D we are seeking a balance across various timeframes.

Question: Many of these initiatives require considerable investment by other Departments of the Government as well as by the private sector in order to be successful. How confident are you that these investments will occur, given current low energy prices?

Answer: We are confident these investments will occur based on the responses we are receiving to DOE's new initiatives from private industry, utilities, and State and local governments. For example, the Federal Energy Management Office (FEMO) recently received major commitments from PEPCO and from the General Services Administration to be used to relight a number of Federal buildings in the Washington area.

DOE has met with HUD to determine how our energy efficient technologies can be used to reduce the waste of energy and dollars in HUD housing programs. This cooperative program is expected to use a modest level of DOE funds ($600,000 reprogrammed in 1990) along with much larger amounts of HUD, utility and State, including Petroleum Violation Escrow Account (PVEA), funds to conduct pilot retrofit projects at selected public housing projects. The States of New York, Texas, Arizona and Minnesota have already shown an interest in participating in this initiative.

Even during a period of relatively low energy prices, DOE is finding that industry is interested in jointly funding projects to find chlorofluorocarbon (CFC) substitutes that minimize energy penalties. For example, DOE is negotiating a contract with the research committee of the Air Conditioning and Refrigeration Institute (ARI) to undertake a jointly funded project on CFC substitutes. We currently have a jointly funded project with insulation manufacturers and the roofing industry on alternatives to CFCs in roofing insulation. DOE also is entering into an MOU with the Association of Home Appliance Manufacturers Research Consortium which has been created to jointly fund industry and government research on CFC substitutes.

Question: Where will the other government agencies obtain funds in these tight budget circumstances?

Answer: Since the initiatives are in areas where those agencies also have responsibilities, their investment will also be leveraged. The collaborative activities will be designed to redirect some funds into more productive uses. For example, HUD currently pays $1.7 billion annually to rehabilitate public housing projects. HUD also pays $850 million to subsidize the energy costs of these projects. By increasing the attention to energy saving measures in the rehabilitation investments, these funds can be used to reduce the cost of energy subsidies.

Question: In conservation, the Administration deletes the government funding for grant programs for low income weatherization, schools and hospitals conservation, and State energy programs. Why?

Answer: Approximately $4 billion in oil overcharge funds have been disbursed to the States for use on these and other energy-related programs. Most of these funds have been allocated by the States for particular programs, but much remains to be spent. Of the $3.4 billion distributed to the States under the Exxon and Stripper Well settlements, $2.1 billion remains unexpended as of the States' annual expenditure reports submitted in FY 1989. Therefore, other than $15 million for competitive State proposals to leverage non-Federal (e.g. utility) funds for low-income weatherization assistance, no appropriated funds are requested in FY 1991 for these energy conservation grant programs.

Question: In weatherization, in particular, indications are that overall funding available to States on an annual basis is beginning to decrease, based on surveys of States using LIHEAP, conservation, and oil overcharge funds. Since only one third of the eligible residences have been weatherized, what sense does it make to reduce the program?

Answer: In addition to the Federal appropriation requested to support weatherization activities in FY 1991, the oil overcharge funds will remain a stable source of support for State and local energy conservation programs for several years. As of the end of FY 1989, the States had not yet expended more than half of the funds they had received. Furthermore, the consent order with Texaco provides that the States will receive $340 million plus accrued interest in payments over the next four years. Other oil overcharge cases are still to be decided. You should be aware that the States have allocated more than $680 million of their oil overcharge receipts to the Weatherization Assistance Program. It is likely that, as new overcharge funds are disbursed to the States, they will continue weatherization activities in accordance with their energy priorities.

Question: Doesn't this program lead to immediate reductions in energy use, particularly in sectors of the economy which can least afford to make investments on their own?

Answer: The Weatherization Assistance Program installs energy conservation materials in the homes of low-income persons, particularly the elderly and handicapped, which helps to reduce the energy consumption in their homes. These individuals could not be expected to make such investments without assistance. In some cases, increased comfort is the result, rather than reduced consumption. A major evaluation of the Weatherization program will help to clarify this question.

Current Policies -- Fossil Energy

Question: Last year, in addition to conservation, you indicated you would review fossil energy research and development closely when considering priorities. Relative to conservation, fossil energy seems to have lost out. Outside of oil and gas, all the other areas, particularly coal research and development and management support at the energy centers, are drastically reduced. Why did this happen?

Answer: The need for fiscal restraint requires difficult choices. As part of this process, we chose to assign additional priority to activities where there was both a strong federal role and the potential for significant near-term benefits. The potentially important near-term benefits was the primary reason for increases in the conservation and oil and gas areas. The coal R&D budget attempted to preserve, as much as possible, those activities that directly relate to acid rain. Other R&D areas were deemed to be of lower priority, and a balanced R&D portfolio required that cuts be taken in those areas. Management support at the ETCs was reduced because it is not as important for advancing the competitiveness of coal technologies as is funding for R&D performed by industry.

Question: Even the levels requested to OMB for coal were reduced severely from current levels. Why?

Answer: DOE's budget request is formulated using guidelines that reflect the Administration's efforts to practice fiscal responsibility. Adhering to these guidelines for FY 1991 means that many programs will be funded at a lower level than the previous year's appropriation. Nevertheless, the Department believes that the program requested in FY 1991 is viable, and balanced. To a large extent, the cuts were not taken in those areas of the coal R&D budget that directly affect acid rain reduction; they were taken in other, lower priority areas.

Question: Since coal is our largest resource, why doesn't it make sense to develop technologies to use it more cleanly and efficiently?

Answer: The Department supports R&D to use coal more cleanly and efficiently. We believe that the ongoing Clean Coal Technology Program coupled with the $110.3 million requested for coal R&D in FY 1991 constitutes the single largest DOE investment in energy research, development and demonstration. The budget request continues to develop more efficient and cleaner coal technologies.

Question: Is it not true that many of the technologies in the Clean Coal Technology program, which Congress initiated and which we both support, came from the Federal coal research and development program?

Answer: Yes, some of the types of technologies featured in projects currently in the Clean Coal Technology Program have been previously funded by the Federal coal research and development program. Some examples include:

- o Advanced Cyclone Combustor
- o Fluidized-Bed Gasifier
- o Hot Gas Cleanup Process
- o Low NO_x/SO_x Burner
- o Atmospheric Fluidized-Bed Combustion Boilers

In some of the cases, however, the specific version of the technology being demonstrated was not developed in the DOE program.

Question: Isn't continuing research and development necessary to support commercialization of these technologies?

Answer: Yes, continuing research and development can help to support the commercialization of these technologies. It should be noted that the Clean Coal Technology Program is a demonstration effort. As demonstrations, many of these projects have a strong development objective associated with their operation. In addition, many of the industrial participants are supporting associated research and development efforts to help solve problems when encountered and to improve the technology.

Research and development efforts are necessary also to bring many advanced concepts that are now immature for a demonstration project to a stage of development that they can be considered for the CCT program. The FY 1991 budget proposes a balanced program to accomplish those goals.

Question: Doesn't it make as much sense to support coal technologies as it does to support oil and gas research, which the budget does, at least at historical levels?

Answer: Based on the high priority and urgency associated with FY 1991 oil and gas initiatives, and the relatively low historical funding levels for oil and gas R&D versus coal, we believe that the FY 1991 budget represents-a balanced and appropriate financial strategy.

Question: A National Research Council (NRC) report, specifies pilot scale research on direct liquefaction of coal, and pilot processing of oil shale as top priorities for a liquids program. Are not liquid fuels the main use of oil, and thus imports, in the United States?

Answer: Liquid fuels are the main use of oil, and thus are the dominant factor in the level of petroleum and petroleum product imports.

The NRC study will be extremely helpful to us in determining research priorities for fossil fuel based liquid fuels.

Question: Does it make sense to try to develop substitutes as the NRC suggests?

Answer: It makes sense to develop liquid transportation fuels substitutes, as the NRC study suggests, to the extent that there is a reasonable expectation that such fuels will be economic and consistent with environmental objectives. The government has supported such development for decades through its support for coal liquefaction and oil shale R&D. However, what is at issue is the level of federal support in the development of these substitutes. These substitutes are likely to be the highest cost and longest-term options for displacing imported liquids, and may not necessarily be alternatives that meet future market demand for fuels that meet both energy and environmental objectives.

Clean Coal Technology

Question: The Committee is pleased that after correspondence to you, and a subsequent meeting, processing of clean coal projects and resulting agreements has accelerated. As a result of the meeting with you, the chairmen and ranking minority members of both the House and Senate Subcommittees wrote to the President on November 20, 1989 seeking resolution of the so called "WEPCO" decision as it related to clean coal project decisions. What is the status of the Administration policy in this area?

Answer: As I stated in my testimony, the WEPCO decision still remains a threat to current and future participants in the CCT program. The Department is continuing to work with both EPA and Congress to resolve the issues. While EPA has expedited the resolution of some project-specific issues in a satisfactory manner, the Department continues to urge EPA to seek a permanent long-range solution to the problem. At the same time, the Department is working with Congress on legislative remedies which may be necessary to fully protect the program.

Question: Are any clean coal projects still being affected adversely by "WEPCO"?

Answer: Yes, not only are projects currently in the Clean Coal Technology (CCT) Program being adversely impacted by the WEPCO decision, it remains an issue of concern to potential participants in future CCT solicitations. While EPA has expedited the resolution of some project-specific issues in a satisfactory manner, a permanent long-range solution to the problem is needed.

Question: A further result of the meeting was an indication that the Department, and you and your Deputy personally, would review the treatment of foreign technology and foreign licensing agreements with regard to the upcoming fourth round of clean coal procurements and consult with Congress on your conclusions. What is the status of that review. (As an aside, the Congress has been satisfied that the current treatment of such patent and licensing issues is reasonable.)

Answer: The Department is currently reviewing existing policies in the technology transfer area in a number of programs and developing new policies for implementation. These new policies should be fully developed within the near future. In terms of the Clean Coal Program, we are considering revising the "American Preference" provision. Other options are also being considered.

Question: Why has a new "American Preference" provision for manufacturing been included in the draft procurement now in circulation? Explain what it is.

Answer: The draft Clean Coal Technology IV Program Opportunity Notice is currently under-going internal DOE review. Based on the public meetings conducted in San Francisco and Boston, a preference was expressed for American manufacturing to the extent that it did not exclude foreign technologies and foreign participation.

The proposed "American Preference" provision states that if a technology owner grants exclusive right to use or sell the technology in the United States, the recipient must agree that a substantial part of the technology will be manufactured in the U.S. This provision does not apply if there is more than one licensor in the U.S. Additionally, DOE can waive this provision upon a showing by the technology owner that reasonable but unsuccessful efforts have been made to obtain a domestic manufacturing license or domestic manufacture is not practical.

Question: What is the reaction of other agencies of the government to this? (Treasury, State, OMB, Commerce, Trade Representative)

Answer: The Department has sought the input from other agencies in the new policies being developed. Different agencies view the issue of domestic manufacturing preference in varying ways. The agencies listed in the question have each had an opportunity to view both the Department's policy direction and the specific provisions included in the proposed solicitation. Those comments have varied both within agencies and among the agencies, with some comments being supportive and some negative.

Question: What do you think the reaction of our trading partners will be?

Answer: The issue presented is not primarily one of trade, but rather one of entitlement to government financial assistance. The proposed policies would apply equally to domestic and foreign owned companies and thus do not discriminate against foreign companies or technologies. We do not believe that the policies will violate any existing U.S. trade agreements.

Question: Is it not correct that manufacturing would take place in the United States in most cases whether you have such a provision or not? If so, why include it?

Answer: In many cases, it is likely that substantial manufacture would take place in the U.S. whether there is such a provision or not. However, the proposed provision would enhance the likelihood of substantial U.S. manufacture, thus providing enhanced benefits to the U.S. economy.

Question: The Committee is concerned that large changes in repayment provisions are being proposed for the next procurement in the face of clear opposition by the industrial participants and those in Congress who have supported the program since its initiation. Over time, the Department has been responsible for the gradual easing of such provisions through the first three procurement rounds. Congress has approved of that approach. Now that the technology is becoming more critical to meet the requirements of clean air legislation in both the short and long term, the Department suddenly shifts gears and suggests much stronger repayment provisions. At the least, this will prolong negotiations; at the worst, it will cause many potential participants to refuse to propose projects. Why have you included much harsher repayment provisions in the draft procurement now in circulation than in the previous procurement?

Answer: DOE does not plan to create recoupment provisions that will make it harder to demonstrate new technologies. It should be noted, however, that the passage of acid rain legistlation would create a significant demand for the new technologies. This greatly reduces the participants' economic risk, and would allow vendors to incorporate some reasonable level of Federal recoupment into their marketing plans and pricing structures. We are continuing to explore this issue.

Question: What do you expect industry's reaction to be?

Answer: The comments at the public meetings indicated that the round three plan was acceptable. However, it was noted that if the PON was amended, then a plan should be provided with more flexibility to accommodate the needs of individual companies since there can be different sources of income and different objectives for each technology. Therefore, DOE believed it was improving the round three plan by developing an alternative for public review.

Question: With the imminent passage of acid rain legislation, is it not even more imperative to demonstrate this technology than before? If so, why increase the repayment provisions to make it harder?

Answer: Yes, it is even more imperative to achieve successful demonstration of clean coal technologies in as near term as possible to provide competitive options for the utility and industrial sectors to meet the objectives of the pending clean air amendments.

DOE does not plan to create recoupment provisions that will make it harder to demonstrate new technologies. It should be noted, however, that the passage of acid rain legislation would create a significant demand for the new technologies. This greatly reduces the participants' economic risk, and would allow vendors to incorporate some reasonable level of Federal recoupment into their marketing plans and pricing structures. We are continuing to explore this issue.

Question: Do you think that the fourth round of procurements should be delayed until the so-called "Sharp amendment" to the House clean air legislation is settled?

Answer: Yes. Two bills now pending in Congress could substantially impact the Clean Coal Technology Program. The Supplemental Appropriations Act, as approved by the Senate and now in Conference, would delay issuance of the solicitation until September 1991. The Clean Air Act amendments, as approved by the House Energy and Commerce Committee and now awaiting action by the House, would radically change the nature of this proposed legislation. Without resolution of these issues, it would be inappropriate to go forward with the issuance of the solicitation on June 1, 1990. To do so would run the risk of having to subsequently cancel or amend it, causing unnecessary expense for both the Department and the participants.

Accordingly, the Secretary of Energy, by letter, dated May 14, 1990, informed the Congress that the Department intended to delay the release of the CCT-IV solicitation.

Question: What is your assessment of what the impact and the timing of the impact from alternative fuels will be?

Answer: The short-term impact (before the year 2000) of alternative fuels will be small, but significant. Effects on ambient air quality and energy usage will be limited by the relatively small numbers of units operating on alternative fuels compared to conventional fuels. Air quality, however, may be improved by the expanded use of various types of reformulated fuels.

The longer-term impact of alternative fuels will be as follows:

- o Possible restraint in conventional fuel prices due to competition for market share by alternative fuels.
- o Enhanced energy security due to more diverse fuel supplies, particularly if domestically produced ethanol or methanol can compete without subsidies.
- o Improved air quality, due both to alternative fuel usage and to use of reformulated conventional fuels.
- o Public acceptance of alternatively fueled vehicles will create an expanded market for alternative fuels and alternative-fuels vehicles.

Patent, Licensing, and Contracting

Question: In addition to clean coal patenting and licensing, the Committee is interested in how the Department treats patent waivers and patent licenses in general. Are you comfortable with the Department's overall patent waiver and licensing policy? Are you reviewing it? If so, when will the review be complete?

Answer: The flexibility of DOE's statutory patent policy has made it adaptable to changing programmatic demands, and thus we are generally comfortable with DOE's overall patent waiver and licensing policy. Currently, DOE's Technology Transfer Policy Group (TTPG) is developing policies for implementation of recent amendments to the Federal Technology Transfer Act of 1986. These policies are focusing on Cooperative Research and Development Agreements and licensing activities at DOE's laboratories. When these policies are formally adopted, it is anticipated that DOE's patent waiver and patent licensing policies will be reviewed for consistency therewith.

Question: Under what conditions are patent waivers granted to companies?

Answer: The conditions under which waivers are granted are set forth in DOE's statutory patent policy, i.e., section 152 of the Atomic Energy Act of 1954 (42 U.S.C. 2182), and section 9 of the Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. 5908), as implemented by the regulations at 41 C.F.R. 9-9.109-6. Small businesses and nonprofit organizations normally do not need to request waivers because they are given the right to elect to retain title to their inventions under the Dole-Bayh Act (P.L. 96-517 and P.L. 98-620).

Waivers may be granted either prior to contracting, for inventions which may be made (advance waivers), or to specific inventions which actually are made (waivers to identified inventions), under a DOE contract for research, development, or demonstration work. Advance waivers normally are granted where the contractor has substantial equity in the contract through significant cost sharing. Waivers to identified inventions are normally granted where DOE is no longer funding the development of the invention and the contractor demonstrates that it has adequate plans and intends to commercialize the invention.

Both advance and identified waivers may be made subject to special negotiated conditions to accommodate specific needs of the contractors or of DOE. These conditions may, for example, allow DOE to recoup its costs or may give the contractor a period of time in which to commercialize a waived invention.

Question: If patent rights are waived, what residual rights does the government retain?

Answer: When patent rights are waived, the government retains, at a minimum, the statutorily required nonexclusive license for governmental purposes, and the "march-in" rights and preference for U.S. industry provisions of Public Law 96-517 ("Dole-Bayh Act"). As noted in the response to question 31, a waiver may also be made subject to specially negotiated provisions.

Question: Are there general guidelines for licensing of U.S. technology abroad? If so, what are they?

Answer: For DOE-sponsored technology retained by laboratory contractors, either pursuant to patent waivers or "Dole-Bayh," licensing guidelines have been developed recently by the TTPG. If agreed to by the contractors, these guidelines would give preference to licenses that will enhance the accrual of economic and technological benefits to the U.S. domestic economy, and would require contractors to consider:

a) whether resulting development will be performed in the U.S. and whether resulting products and components will be substantially manufactured in the U.S., or
b) whether the proposed licensee has a business unit located in the U.S. and whether significant economic and technical benefits will flow to the U.S.; and further
c) whether in licensing any entity subject to the control of a foreign company or government, such foreign government permits U.S. organizations to enter into licensing agreements, and has policies to protect U.S. intellectual property rights.

In addition, such contractors are bound by the preference for U.S. Industry clause of 35 U.S.C. 204 (generally, allows no assignment or exclusive license unless recipient agrees to substantial manufacture in the U.S. for use and sales in the U.S.).

For patents owned by the Government, Administration policy is contained in Commerce Department Regulations on Licensing Government-Owned Inventions (37 C.F.R. 404). Generally, licenses, exclusive or nonexclusive, may be granted only if the licensee agrees to substantial manufacture in the U.S. for U.S. sales (37 C.F.R. 404.5(a)(2), 35 U.S.C. 209(a)), and for exclusive licenses under foreign patents, the agency must consider whether the interests of the Federal Government or United States industry in foreign commerce will be enhanced (37 C.F.R. 404.7([illegible])(1)(ii), 35 U.S.C. 209(d)).

Question: How is foreign ownership treated with regard to research and development and with regard to waivers and licenses?

Answer: With regard to research and development, there is no general preference for domestic contractors. However, in certain situations contractual restrictions do apply when a contractor performing research and development has foreign ownership.

When a DOE contract involves access to classified information or special nuclear material, the Department of Energy Acquisition Regulation provisions (DEAR Subpart 904.70, 952.204-73, and 952.204-74) concerning foreign ownership, control, or influence (FOCI) over DOE contractors apply. These provisions are designed to protect against an undue risk to the common defense and security which may result if classified information or special nuclear material is made available to contractors who are subject to FOCI. DOE contractors are required to submit information which will help DOE determine if award of a contract may pose an undue risk to the common defense or security and how to avoid or mitigate such a risk.

In classified research contracts, DOE includes contract clauses which are intended to protect against a contractor's making unclassified information about nuclear technology available to certain sensitive foreign nations. These provisions (DEAR 904.404(d)(3) and 952.204-71) provide procedures designed to protect the flow of sensitive information to foreign interests.

With regard to patent waivers, foreign entities may request patent waivers under the same conditions as domestic firms. Both foreign and domestic firms are subject to the preference for U.S. industry set forth in 35 U.S.C. 204. Specially negotiated provisions requiring a waiver recipient to give at least initial consideration to licensing U.S. firms have been included in some waivers in response to program needs or Congressional guidance, such as adequate recognition of the contribution of the U.S. government in the case of fuel cells.

With regard to licensing of patents by DOE laboratory contractors, the TTPG-developed guidelines mentioned in the response to Question 33 have as their primary focus the economic and technological benefits flowing to the U.S., rather than foreign ownership. Similarly, for licensing of DOE-owned patents, the primary focus is on economic benefits to the U.S. (substantial manufacture in the U.S.), rather than on foreign ownership.

Question: Do you define "foreign" on any uniform basis?

Answer: With respect to foreign ownership, control, or influence over DOE contractors who have access to classified information or special nuclear material, "foreign interest" is defined in the DOE Acquisition Regulation (DEAR 904.7002, 952.204-74) as any of the following:

a. A foreign government or foreign government agency;

b. Any form of business enterprise organized under the laws of any country other than the U.S. or its possessions;

c. Any form of business enterprise organized or incorporated under the laws of the U.S., or a State or other jurisdiction within the U.S., which is owned, controlled, or influenced by a foreign government, agency, firm, corporation, or person; or

d. Any person who is not a U.S. citizen.

However, with respect to licensing of DOE-sponsored technology, foreign ownership is not determinative; therefore, no definition of "foreign" has been formulated. (See answers to Questions 33 and 34.)

Question: Is it really possible to have a unified policy or must policy be made more or less on a case by case basis?

Answer: While it may be possible to have unified policy guidelines setting forth objectives and considerations, flexibility in applying such guidelines is necessary.

Question: Have you initiated any new policies with regard to waivers and licenses recently? If so, please describe them.

Answer: Policies have been developed by the TTPG for licensing of laboratory contractor inventions, as described above. New policies regarding patent waivers and licensing of DOE inventions have not yet been formally implemented; however, existing policies will be reviewed for consistency with TTPG policies.

Question: In cases such as the Metals Initiative and the High Temperature Materials programs in conservation, which are designed specifically to build U.S. industry, how do you limit foreign participation, if you do?

Answer: In both the Steel Initiative and the High Temperature Materials programs, there is no direct prohibition against foreign participation. In fact, in the Steel Initiative a Canadian company was selected as a participant in order to benefit the overall program. In both programs, however, attempts have been made to benefit U.S. industry by limiting the transfer of intellectual property to foreign concerns and by requiring a U.S. preference in the licensing of intellectual property.

Strategic Petroleum Reserve - Use

Question: This Committee has questioned consistently the lack of standby plans for allocation of energy, in general, and the Strategic Petroleum Reserve oil in particular, in the case of energy emergencies. Since our last meeting, have you considered any modifications to the authorities available with regard to the use or allocation of SPR oil? If so, please explain.

Answer: The question raised is not one of legal authority, but rather of policy. Section 161(e) of the Energy Policy and Conservation Act (EPCA) empowers the Secretary of Energy to allocate Strategic Petroleum Reserve (SPR) oil. The Strategic Petroleum Reserve Distribution Plan, Amendment No. 4 to the SPR Plan, provides for the use of this authority, if necessary, for up to 10% of the SPR oil sold in a given month.

However, the Department has not changed its approach to the use of the SPR in energy emergencies. If the market is allowed to work unencumbered by allocation or market intervention regulations, the economics of a situation will drive the decisions made by suppliers and consumers, and the market will most efficiently allocate the product. The SPR would provide additional supplies to the oil market, and would significantly reduce price increases that would accompany a shortage as large or larger than the supply disruptions experienced in the 1970s.

Question: Have you asked for legislative remedies? If so, what is their status?

Answer: With regard to the allocation of SPR oil, the Administration has not requested additional legislation. As indicated above, SPR allocation authority already exists. If a policy decision were made to rely more heavily on SPR oil allocation, it could be implemented by amending the SPR Distribution Plan. There is no intention to amend the Plan at the present time, however.

With regard to the more general question of oil allocation, legislation to provide comprehensive allocation authority to the President has not been requested, nor does the Administration believe it is needed. The present Administration continues to advocate a policy of free market adjustment to oil supply disruptions, supplemented by an early release of SPR crude oil supplies, in coordination with the emergency response measures taken by our partners in the International Energy Agency.

Question: Do you think that the Reserve should be available for domestic emergencies? If so, what kind?

Answer: Yes. At the present time, the EPCA restricts a Presidential finding of a "severe energy supply interruption" to an interruption in the supply of petroleum imports, sabotage or an Act of God. The Department believes that it is important to remove the term "imported" from existing law, so that the SPR can be used in case of a serious national energy supply shortage resulting from an interruption in the supply of domestic petroleum. Such a shortage could result, for example, from an extended disruption in oil supplies from the North Slope of Alaska. In that case, the potential effect on oil supplies and prices in the U.S. market could be sufficiently severe to justify a drawdown of the SPR.

Question: Do you think the President, through the Secretary, should be able to allocate oil or oil products either from the Reserve, or from general supplies, if the market fails in an emergency?

Answer. As discussed above, the Secretary of Energy does have the authority to "allocate" (i.e., direct the sale of) SPR oil. Other oil allocation authorities presently exist, including section 101 of the Defense Production Act of 1950 and the EPCA section 251 authority to take actions necessary to meet U.S. obligations under the Agreement on an International Energy Program. The Administration does not believe that there is a need for additional authority to allocate oil supplies in an emergency.

Strategic Petroleum Reserve - Size and Location

Question: Please explain the main reasons why the Administration does not favor increasing the size of the SPR above 750 million barrels.

Answer: After undertaking an analysis of a broad range of economic, foreign policy, and national security factors, the Administration has determined that the development of a 750 million barrel SPR is an appropriate and prudent oil stockpiling policy for the United States. The results of the analysis were reviewed by the President's Economic Policy Council whose members unanimously supported the 750 million barrel goal.

The SPR is the world's largest Government-owned petroleum stockpile. It serves as both a powerful deterrent against oil supply disruptions and an effective instrument to minimize damage to the economy if such disruptions should occur. By 1999, the U.S. SPR alone will have the capability to offset for six months, barrel for barrel, an interruption on average of four million barrels per day. Such an interruption would be larger than any ever experienced.

The Administration decided to retain the goal of a 750 million barrel SPR for several important reasons. First, because of the discretionary character of expansion beyond 750 million barrels, we need to be prudent in undertaking further investment in the Reserve, carefully weighing the expected budgetary costs against the marginal benefits that a larger SPR might provide. From the analysis we have conducted on the advantages and disadvantages of alternative sizes, it is apparent that the SPR should be evaluated as an insurance policy. When the probability of a range of worst case disruptions is very low, which is our current judgment, the high cost of maintaining insurance above a reasonable level is not justified. The agencies participating in the Administration's recent study on the size of the SPR have concluded, based on a CIA assessment, that the chances of a disruption of the magnitude requiring expansion from 750 million barrels to a full one billion barrels are not anywhere near high enough to warrant such an expansion. One of the key findings of the size study is that the incremental economic benefits of increasing the SPR from 750 million barrels to one billion barrels are far outweighed by the additional costs. Using mid-range assumptions, the study found that the expected present value costs of moving from 750 million to one billion barrels exceed benefits by 4.5 to 1.

Secondly, in the recent size study, participating agencies with foreign policy and national security responsibilities provided an in-depth review of strategic considerations affecting SPR size, such as national security, military preparedness and foreign policy objectives. These strategic and other non-economic factors are also central to policy decisions on SPR size. Based upon this extensive study, it is the judgment of the Administration that a 750 million barrel SPR provides substantial protection against a range of worst case disruptions and ample deterrence against embargoes. Increasing the SPR to one billion barrels would not materially affect these factors.

Finally, we are substantially better prepared to deal with an oil supply interruption today than we were in 1979. By the end of 1990, there will be the potential to offset, for six months, a loss of between 8 and 13 million barrels per day of oil supply, or a maximum of 25 percent of free world oil consumption, assuming all excess capacity, including that in the Middle East, is used. The U.S. SPR alone will provide the capability to offset, barrel for barrel, and for six months, an interruption on average of 3 million barrels per day. IEA government controlled stocks would add an additional minimum of 2 million barrels per day. Fuel switching and potential incremental supplies from excess world production capacity would provide additional offsets of between 4 and 7 million barrels of oil per day.

In summary, we believe that the economic effects of a broad range of potential supply disruptions could be mitigated through use of existing and planned strategic stockpiles held by all consuming nations, and especially by IEA member states. The coordinated use of these stocks would provide protection against a range of worst-case disruptions of a magnitude substantially greater than any disruption experienced in the last forty years.

Question: What would be the increased cost of going to a billion barrels?

Answer: There are two aspects of increasing the size of the Reserve from 750 million to 1 billion barrels: facilities and oil fill. The more significant of these is the cost of oil, and that will depend directly on oil prices at the time of acquisition. In the Alternative Financing study for the Strategic Petroleum Reserve, which was sent to the Congress in February 1990, assuming a fill rate of 75,000 barrels per day, the direct budget requirement for facilities and oil was estimated at between $10 billion and $15 billion, with a base case price estimate of $12.4 billion.

Question: What conditions have changed in world oil markets and in reserves since the original legislation contemplated a billion barrel reserve?

Answer: The world oil market is much changed since the late 1970's, and is much better prepared to deal with disruptive events. For example, oil is now a listed and actively traded commodity on world community markets, substantial new suppliers outside the Middle East now exist, producing countries have invested in refining and retailing operations, and energy efficiency remains important despite lower oil prices. The United States now has strategic stocks of over 580 million barrels in the Strategic Petroleum Reserve and is continuing to build these stocks to achieve the 750 million barrel goal. Our allies in the Organization for Economic Cooperation and Development and the International Energy Agency (IEA) also have sizable strategic stocks to call upon in the event of a disruption, and we have worked closely over the years to coordinate our policies and plans with them, should a disruption occur.

By the end of 1990, the U.S. SPR alone will provide the capability to offset, barrel for barrel, an interruption of an average 3 million barrels per day for six months. IEA government controlled stocks could add, if necessary, up to 2 million barrels per day to world oil supplies. Fuel switching and potential incremental supplies from existing unused world production capacity could also provide substantial additional offsets of as much as 4-6 million barrels per day between now and 1995.

In the current world environment, major disruptions run counter to the self-interest of both producers and consumers. Any substantial disruption of output from one or more of the larger producers, which would be necessary for a major disruption, would undermine the profitability of their large downstream investments in consumer nations, substantially reduce their income from oil production, which for many is the sole meaningful source of national revenue, and cause them to lose market share. Consumers would react to the higher oil prices engendered by a disruption by increased conservation, fuel switching, adoption of alternative energy technologies, and development of hydrocarbon resources outside of the geographic area involving the disruption. This is the pattern that emerged from previous oil disruptions which, notably, took place when IEA strategic reserves were non-existent or very limited, and at a time when no major producer had invested in downstream operations in IEA member countries.

Finally, with respect to the comment that the original legislation contemplated a billion barrel reserve, it should be noted that one billion barrels is the maximum size authorized under the 1975 Energy Policy and Conservation Act (EPCA). The EPCA only required that an SPR of approximately 500 million barrels be developed by 1982. The 500 million barrel size was based on the total volume on crude oil imported into the U.S. in the three consecutive months during the 24-month period preceding the date of enactment of EPCA in which the average monthly import levels were the highest. We are unaware of an analytic or substantive basis for selection of the maximum SPR fill level by the Congress.

Question: What have been the largest reductions in daily world supply in recent history?

Answer: The October 1973 Arab-Israeli war led to an embargo that resulted in production cutbacks averaging 1.6 million barrels per day for five months. For the period October 1973-March 1974, this represented a 3.4 percent supply disruption in free world oil demand.

The November 1978-April 1979 Iranian Revolution resulted in production cutbacks averaging 3.7 million barrels per day for six months, or a total of 7.6 percent of the free world oil demand.

The October 1980-January 1981 outbreak of the Iran-Iraq war resulted in production cutbacks averaging 3 million barrels per day for three months, or a total of 6 percent of the free world oil demand.

Question: Would a 750 million barrel reserve protect us at those levels of reduction?

Answer: By FY 1999, the 750 million barrel U.S. SPR alone will have the capability to offset, barrel for barrel, an interruption of an average 4 million barrels per day for six months. Such an interruption would be larger than any experienced in this century.

Question: Hawaii, the West Coast, and New England have often argued for regional storage of crude oil or petroleum products. Have you done any recent studies on such reserves? If so, please provide details on the results.

Answer: The Department of Energy addressed the question of regional crude oil and petroleum product storage in its "Report to the Congress on Expansion of the Strategic Petroleum Reserve to One Billion Barrels", submitted in April, 1989. The Department reiterated its position that a centralized crude oil reserve minimizes storage costs and environmental impacts, and maximizes system flexibility to respond to a wide range of supply interruptions. The Gulf Coast region was selected for the centralized storage because salt domes are widely available and the Gulf Coast is the largest center of petroleum refining and distribution in the U.S. In addition, petroleum storage in underground salt dome caverns has proven to be safer, more economical, more environmentally sound, more secure, and easier to maintain than any other available storage method.

Petroleum product storage has several disadvantages relative to crude oil storage. These disadvantages include the loss of flexibility to respond to various product demands, the need to rotate stocks to avoid product deterioration, and the added cost of segregated product storage and distribution capabilities. In summary, the extra cost of product storage would not be justified at this time. However, the Department will continue to monitor U.S. refining trends and U.S. product vulnerabilities.

Question: Do you believe that a regional product reserve on the East Coast would have mitigated price increases last December during the unexpected cold wave? Why or why not?

Answer: The cost/benefit effectiveness of regional product reserves to offset price increases or transportation and distribution problems depends on many variables, including the frequency of the need to draw upon the reserves. Establishing a regional product reserve is essentially the same thing as taking out an insurance policy. There is a cost associated with it, and at some point the cost of carrying the insurance exceeds the benefits derived from it.

The circumstances that occurred at the end of December -- a tight supply market for middle distillate, a significant short-term increase in demand, and a sharp price spike -- is a phenomenon that last occurred in the winter of 1983. The cost of maintaining a regional petroleum reserve for middle distillate on the East Coast for the intervening six years might well have exceeded the possible benefits it would have provided last December.

Strategic Petroleum Reserve - Financing

Question: The Administration is requesting the authority to lease oil for the Strategic Petroleum Reserve instead of buying it. Please explain why.

Answer: When the Government buys oil for the Strategic Petroleum Reserve, all of the money required to buy, transport and store the oil must be appropriated and expended in the first year of the process. It would be a great advantage to the Government if it could reduce and defer the outlays, and simultaneously increase the level of fill up to the 750 million barrel goal. After studying a variety of alternatives for financing the Strategic Petroleum Reserve, the Administration has come to the conclusion that only oil "leasing" from a low cost producer appears to offer the opportunity of achieving those objectives.

Question: Your letter of February 2, 1990, says in part, "The size study assumed the continued use of the current method of financing the SPR and did not assume the use of alternative financing mechanisms, because alternative financing mechanisms generally would not result in government cost savings and any such savings are not at present quantifiable." In that case, why do you want generic leasing authority?

Answer: The quoted statement was intended to draw a distinction between alternative financing mechanisms "generally" (including, but not limited to oil "leasing"), and oil "leasing" specifically from a major oil producing country. Where such a country is willing and able to produce oil at a cost significantly below the market value of that oil, and provide that oil for storage by the United States Government, the "leasing" concept can result in a cost saving for the lessee. Of course, the actual cost of "leasing" would be the subject of negotiation between our Government and the producer. Pending such negotiations, the savings from "leasing" are unknown and it would not have been prudent to base the size study on an assumption of cost savings from "leasing." Nevertheless, the potential exists for cost savings in filling the SPR to the 750 million barrel target level and the Administration is requesting authority to proceed to explore this potential by determining what specific terms suppliers would be willing to negotiate. The Department's legislative proposal would permit leasing only when it was cost-effective relative to purchase.

Question: Your letter also states "...only oil leasing from an oil producing country with excess production capacity appears to offer the possibility for reducing the costs of SPR oil acquisition..." What countries have excess production capacity?

Answer: The concept of excess producing capacity means that a country could produce more oil than it is actually producing, at a cost less than the market value of the oil. Most countries that are members of the Organization of Petroleum Exporting Countries (OPEC) have excess capacity, in part because they have agreed to a production quota established by OPEC. However, it is widely recognized that several OPEC member countries are exceeding their quotas and that others have fairly low levels of excess capacity. In addition, the amount of excess capacity can change simply by agreement of the member countries to a new quota. Therefore, the countries with capacity significantly above their producing levels are assumed to be the most capable of becoming lessors of oil. Those countries are Iraq, Kuwait, Libya, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela. Of these countries only Kuwait, Saudi Arabia, the United Arab Emirates, and Venezuela have been approached to discuss leasing. Outside of OPEC, Norway has expressed an interest in leasing oil to the United States.

Question: Why would they be interested in reducing our oil acquisition costs?

Answer: Our potential leasing partners would not be primarily interested in reducing our costs. We believe that they would be motivated by three factors. First, by moving oil stored in their own natural reservoirs to our manmade Reserve they could generate a current cash flow in the form of the lease payment. Second, they may share in the proceeds in the event of an SPR drawdown. Third, oil exporting countries increasingly see their best interests as being served as a long term supplier of crude oil to the United States. Entering into a "lease" contract with strategic overtones would help any country to dispel the image of being an unstable oil supplier, and allow that country to increase its market share in the United States over time.

Question: With what countries have you discussed this concept? What was their reaction?

Answer: During the course of the alternative financing study, detailed, exploratory meetings were held with Kuwait, Mexico, Norway, Saudi Arabia, and the United Arab Emirates. Other, less detailed discussions were held with representatives of Nigeria, Venezuela and the United Kingdom. The role of the SPR in U.S. energy policy was understood and the potential for cooperating with the U.S. in filling the SPR was in no instance rejected. Indeed, there were indications that this type of cooperation could be viewed as a positive feature of oil leasing. Some countries indicated an interest in seriously exploring the possibility of a SPR oil "lease" or comparable arrangement. For countries that appear more willing and able to undertake oil leasing, several important concerns were raised:

-- Competitive Bidding: Producer governments expressed unwillingness to bid for an oil lease in an open competition; some countries, however, indicated an interest in having further bilateral discussions to pursue mutually beneficial lease terms.

-- Taxes: The potential applicability of Federal, state, and local taxes either to periodic fees or to sales gains on assets was viewed as a major obstacle, which would need to be addressed either through higher contract payments or special tax treatment. Under the current SPR cash purchase approach, foreign sellers are liable for no U.S. taxes.

- Cargo Preference: Some governments had a strong preference for arranging their own shipping of crude oil for the SPR, rather than having 50 percent of the oil transported in U.S.-flag ships. Even for others, it is clear that the U.S. Government would have to absorb the extra costs associated with use of U.S.-flag vessels.
- Return of Capital: Some nations expressed concern about the potential for having the oil returned to them at the option of the U.S., potentially under unfavorable market conditions. Some also expressed concern over the potential for having their oil sold under non-emergency conditions.
- Commercial Uses: Some nations are interested in storing oil in or near the U.S. market for commercial reasons, which could involve either collocating commercial stocks in facilities storing SPR oil or providing limited producer nation access to its leased oil.

In all of the meetings it was made quite clear that the Government did not yet have authority to enter into the types of leases being discussed and that the meetings were not to be considered negotiations.

Question: Is it not correct that a lease, even of large quantities of oil, would not bring large revenues on an annual basis to a country? (100,000,000 barrels would bring $70,000,000)

Answer: The terms and conditions of a lease would be the subject of negotiation between the lessor and the United States. However, the break even value of a lease relative to purchasing oil is a straightforward calculation, and limits the amount that the United States would be willing to pay as a lease fee. Of course, there may be a negotiating trade-off between these periodic payments, and participation in the appreciated value of the oil during a SPR drawdown. Depending on how the appreciated value is shared, not insignificant revenues could be involved.

Question: Why would they want to go to such trouble except for the foreign policy advantages?

Answer: As noted above, the lessor would receive a current annual return versus nothing, the lessor would continue to own the oil although they would not control it, and might share in the proceeds during a SPR drawdown.

Question: Do you assume Congress would give you freedom to contract for such oil without some sort of oversight or preapproval process? Why should Congress do that?

Answer: The Administration has drafted legislation which would allow the Department to enter into negotiations for "lease" oil. At this time our budget does not assume that we will "lease" any oil, and does assume that future SPR fill will require appropriations to buy the oil. However, given the many demands on available Government funds, the Administration proposes that we take the next step to explore the leasing alternative. It is not the Administration's intent to bypass Congressional oversight on this matter. We believe that the oversight mechanisms which are already in place or are associated with the Administration's draft legislation will allow ample opportunity for Congress to review this initiative. The Department's ability to acquire oil under a "lease" contract also will be subject to annual appropriations. Also, the "fast track" procedures provided for by the Administration's draft legislation would assure Congressional oversight of any "lease" negotiations, and also could enable the Congress to prevent any unacceptable contract by failing to approve needed tax legislation submitted pursuant to the "fast-track" procedures. In addition, the Department fully expects to work with the other Departments of Government normally involved in foreign affairs.

Question: If the government reconsidered a lease once it was in place and had to purchase alternative oil, wouldn't it likely cost more than if purchased originally?

Answer: Not necessarily. The answer depends on a number of unstated assumptions, and the result could be as the question implies, or the very opposite. If, for example, the "reconsideration" was pursuant to an option exclusively in favor of the United States, giving it the choice of extending the contract, buying the oil, or returning the oil, the Government would have the opportunity to return the oil at a time of low prices and buy oil at an effective cost below the current market price. Of course, this "risk" would be factored into the supplying country's lease terms.

Naval Petroleum Reserves - "Lease" Instead of "Sell"

Question: What are the principal features of legislation you are preparing to allow you to "lease" the Naval Petroleum Reserves instead of selling them?

Answer: The legislation drafted by the Department is under review by the other Departments of the Executive Branch. Therefore, we cannot say that the legislation which is finally proposed by the Administration will contain all of the provisions which are in the draft. Nevertheless, certain principal elements are certain to be in the Administration's proposal. The Administration proposes to: receive fair market value, subject proposed leases to antitrust review, use part of the receipts for a Defense Petroleum Inventory, and make the U.S. Claims Court the jurisdiction for California's monetary claims relating to "school lands." The differences associated with a lease rather than divestiture are timing of compensation to the Government, the land remaining in Government ownership when the oil and gas reserves are exhausted, differences in the application of real property taxes, accounting for the receipts to the Federal Government, the ability to share price fluctuation changes through use of a royalty, and the ability to control production and environmental impacts through use of lease stipulations.

Question: Have the authorizing committees shown any interest in the legislation?

Answer: Individual members of Congress have expressed interest in the concept of leasing. However, because we have not yet forwarded the legislation and no hearings have been held or scheduled, we have not attempted to poll all of the members of authorizing committees.

Question: What indications do you have that anyone would be willing to lease the Reserves with a bonus of $1.6 billion and continuing royalties? On what assumptions do you base your figures?

Answer: The Department has not polled the private sector regarding their interest in leasing the Naval Petroleum Reserves, but Elk Hills is an attractive oil field and we expect a great deal of interest, once legislation is enacted. The Department's assumptions are in line with the SPR Financing Study Chapter VIII. The Low Price Case from the report was used with a 13% discount rate (about 10% plus inflation) and current Federal and State tax rates. The figures assume no local property tax except to lessee capital improvements. These assumptions are closer to the FY 1991 budget assumptions.

Question: Is there a financial analysis of the proposal available?

Answer: DOE has not written up the specifics of the FY 1991 Budget Case. Chapter VIII of the SPR Financing Study explains the logic, and the basic data are compatible.

Question: What do we gain by leasing rather than producing the Reserves ourselves?

Answer: By leasing rather than producing the Reserves ourselves, we gain up front cash payments, royalties reflecting trends in production and prices, and Federal income taxes from the new operator. Leasing removes the U.S. Government from competing in the oil business and can finance for the Department of Defense a readily usable Defense Petroleum Inventory (DPI). Leasing also allows us to refocus DOE resources on other energy initiatives and the Reserve will benefit from potential efficiencies from private operation.

Question: Is it not correct that no one will make a lease bid unless they assume that they will make a substantial return on their $1.6 billion investment?

Answer: Yes, we assume that lessees would want to make a return on their investment.

Question: Why should that return go to the private sector instead of the government?

Answer: The Government owns and produces the Naval Petroleum Reserves because of determinations made approximately 70 years ago that the military required reserves of oil for use in emergencies. Since 1976, the Reserves have been produced for other purposes, but always with the idea that these were military reserves. However, after 14 years of production at the maximum efficient rates, neither Naval Petroleum Reserve No. 1 nor No. 3 is capable of providing the incremental production that the armed forces might need in the event of a disruption of supplies. The Administration is proposing to substitute the Defense Petroleum Inventory for the role currently being played by the Naval Petroleum Reserves, a role that is fully within the purview of the Government.

In addition, while it is impossible to quantify, we believe that additional cash flow could be generated from these Reserves by a reduction of costs and an increase in production efficiencies if the Reserves were managed by private entrepreneurs. It is this expectation of efficiencies generated by new management which causes private companies to divest themselves of assets and whole subsidiaries, and other companies to purchase those same assets. Efficiencies would produce benefits that the private sector and the Federal Government would share. In other oil and gas leasing programs, the Federal Government has done quite well, receiving a large portion of the economic rents without the need to invest large amounts of scarce Federal funds. The Administration believes that it should concentrate on matters properly of concern to the Government, and that day-to-day decisions on oil field operations are properly the concern of the private sector.

Question: Aren't the reserves of oil remaining well enough defined so that a bidder would have much more assurance of profit than he or she would in normal government leasing situations? If so, aren't we almost assuring a profit for someone else that normally would go to the government? Why should we do that?

Answer: Not necessarily. The big up-front bonus payment creates a financial risk for the lessee. Royalty payments are "off-the-top" of revenues, so the lessee bears all of the risk of operating costs. The lessee may have very low production risks based on proved producing reserves, but the financial risk associated with price changes and the uncertainties of marginal activities such as drilling, exploration, and facilities development create a real risk that the lessee may not get a rate of return on investment that would be comparable to the rate of return from other investments. The Naval Petroleum Reserves should be treated the same as any other oil fields, and the Government should avoid competing with the private sector simply because these assets were developed while in the Government's possession. Furthermore, experience has shown that the most optimistic firms tend to be the successful bidders. This so-called "winners curse" means that the lessee is not guaranteed a profit.

Question: Do you believe that the constant proposals to sell, and now lease, the Reserves result in the Administration not giving sufficient attention to capital improvements and exploration which would enhance the value of the Reserves?

Answer: No. Despite past Administration proposals to divest the Naval Petroleum Reserves, the Administration budget contains a full funding provision for operation and maintenance, facilities development, development drilling and exploration. The Department's philosophy has been that proper development and operation of the field would increase the sale or lease value, and that cutting into the economic activities of the field would be very short sighted.

Question: If the Defense Petroleum Inventory of 10 million barrels included in this proposal is such a priority item, why doesn't the Department of Defense ever request it independently?

Answer: The Naval Petroleum Reserves have been a major part of the Defense Department fuel supply assurance program for 10 years. While the Reserves have continued to provide protection for the military and have not required direct administration or the appropriation of funds on the military budget, this situation was acceptable. However, the Naval Petroleum Reserves are losing their ability to significantly support the Department of Defense in the event of an emergency. Oil production is less than half of its peak in 1981 and there will be a continuous decline in the future. The Department of Defense would like to plan for the future by establishing a supply of crude oil which will not be dissipated with time, and the Defense Petroleum Inventory is the proper method of developing such a Reserve. Nevertheless, the military still has at its disposal the production of the Naval Petroleum Reserves without incurring direct outlays on the Department of Defense budget. If DOD were to propose a Defense Petroleum Initiative in addition to the Naval Petroleum Reserves, it would be a new initiative rather than a substitute and would displace funds from other DOD line items. And, of course, DOD is also experiencing severe budget constraints which make funding only the most critical new initiatives possible.

Question: You have been seeking special exceptions for the Department of Energy for salaries for certain critical positions, and for allowing personnel in certain positions to "double-dip" on retirement benefits so that you can fill jobs. What kind of jobs are those for which you request such actions?

Answer: The jobs for which "critical position" salary authority would be contemplated are those key management, technical and scientific positions which require the absolute in excellence and rare technical expertise for running the Department's sensitive nuclear defense and other programs. They would include positions such as the Assistant Secretary for Defense Programs and Assistant Secretary for Environment, Safety and Health, as well as other senior positions involving leadership of the Department's scientific, technical and other activities where distinctive skills are required. For example, certain types of expertise regarding the weapons program can be found only in current or former scientists in the National Laboratories and some retired military officers, and in both circumstances, the special pay and Dual Compensation Act waiver authority are indispensable if the Department is to be successful in attracting these individuals.

Question: Is one to assume that those who are incumbent to these types of positions are not competent?

Answer: In the first place, I would note that we do not have current incumbents in some of these positions, such as the Assistant Secretary for Defense Programs and Assistant Secretary for Environment, Safety and Health. As a more general proposition, the question is not confined to seeking "competent" individuals. Instead it involves acquiring particular types of expertise, together with professional track records of superiority in accomplishment, that transcends ordinary and unspecialized competence.

Question: Since you currently do not have this authority, what do you plan so do instead of carrying out your mission?

Answer: The need for this type of authority has been discussed more and more widely with the Congress over the last year. I find it difficult to believe that the Congress, when confronted with the stark reality of the need for special excellence and expertise in some of the positions currently providing for the public safety and welfare, would fail to act to remedy a clearly demonstrated problem. Obviously until such action occurs, we will continue as we have in our efforts to attract the best people we can within the limitations under which we currently must function.

Temporary Hiring Moratorium

Question: You placed a temporary moratorium on personnel actions at headquarters affecting all GS-13 through GS-15 personnel on March 14, 1989. Is that moratorium still in place? If so, why? If not, when was it lifted?

Answer: Yes, the moratorium is still in place for some organizations.

The moratorium was lifted from organizations as new organizational structures and program directions were finalized and approved by the Secretary. This was done on an office by office basis in response to direct request and appropriate justification during the fall and winter months.

The hiring moratorium has been lifted from the following organizations:

- Defense Programs
- General Counsel
- Inspector General
- Conservation and Renewable Energy
- Congressional and Intergovernmental Affairs
- Office of New Production Reactors
- Nuclear Energy
- Environmental Restoration and Waste Management
- International Affairs and Energy Emergencies
- Policy, Planning and Analysis

It remains in place for these:

- Fossil Energy
- Office of Energy Research
- Office of Procurnent and Assistance Management
- Office of Administration and Human Resource Management
- Office of Civilian Radioactive Waste Management
- Office of Public Affairs
- Office of Nuclear Safety
- Economic Regulatory Administration
- Energy Information Administration
- Environment, Safety and Health - (Technical positions are exempt)
- Office of Hearings and Appeals
- Office of Minority Economic Impact
- Board of Contract Appeals
- Office of Financial Management and Controller

It will continue to be lifted on an office by office basis as we finalize the new directionspof the various programs within the Department.

Numbers of Noncareer Personnel

Question: With regard to personnel, the Committee is concerned about the influx of schedule "C", non-career SES personnel, and consultants on personal contract to the Department. These numbers have at least doubled since you took over the Department. Why do you and your fellow appointees need such amounts of non-career "personal" assistants?

Answer: At the time of my appointment, the numbers of non-career personnel had already begun winding down in anticipation of the transition. Actual numbers as of April, 1988 present a better comparison of the last Administration's appointments with this Administration's. From that period to now, the Department has had a 50% increase in these types of appointments, not a 100% increase. The Department has needed executive leadership in the numerous issues currently being pursued which either represent areas new to the Department or areas given new emphasis. The need for executive leadership has resulted in additional non-career SES's in the areas of the initiatives. For example, we have non-career executives providing policy direction in environmental restoration and waste management, nuclear safety, the development of the National Energy Strategy and in administrative areas including procurement. Additional Schedule C personnel have been required to support these non-career executives in thier policy-making roles.

Conversion of Non-career Personnel to Career Appointment

Question: Between February, 1990 and now, the number has decreased from 217 people to 181. How many of these people have been converted to career positions?

Answer: None have been converted to career positions. The primary reason for the decrease has been the release of consultants.

Fossil Energy Staffing Levels

Question: In Fossil Energy, for example, the Committee directed in the FY 1990 Conference Report that headquarters staffing levels be reduced, but apparently there has been a growth in non-career personnel in the direct office of the Assistant Secretary instead. What is the justification for this?

Answer: There has been increased emphasis on programs for Clean Coal Technology requiring additional resources devoted to the Fossil Energy area.

Concern that Non-career Hiring has Adverse Effect on Career Staff

Question: The Committee is concerned that the pattern of requesting high salary exemptions, freezing promotions and mobility at the mid-level (GS-13-15), and the influx of non-career personnel will have a detrimental effect on career personnel, the vast majority of whom have shown competence and loyalty to the government in general and the Department in particular. Do you have the same concern?

Answer: During the first year of this Administration, the transitional period, the Department has focused on staffing for new Administration initiatives and new emphasis areas. As a result, the Offices of Environmental Restoration and Waste Management and Nuclear Safety were established. Additionally, emphasis has been placed on further development of the National Energy Strategy and administrative areas such as procurement. The temporary moratorium on promotions and mobility at GS-13-15 was put in place in order to get a handle on the Departmental budget; to asure the best utilization of our human resources; and to allow the new heads of organizations to make selections at these levels. This has been communicated to the career workforce through a number of "All Hands" meetings and Secretarial Notices. Some organizations have already been released from the temporary moratorium. However, there are remaining Presidential nominations to be made within Defense Programs, Environment, Safety, and Health, and Energy Research. When these appointments have been confirmed, we will be better able to judge use of our resources and other relief may be possible.

Impact of Non-career Hiring on Career Staff

Question: Do you think these action have had such an effect?

Answer: Again, during each phase of the transition, we have kept the lines of communication open with all of the career workforce. This is no different from the transitional period of any previous Administration when the leadership must set new directions and initiate new programs for the agency.

QUESTIONS SUBMITTED BY HONORABLE SILVIO O. CONTE

Home Heating Oil

Question: What is the scope and nature of the long-term study now underway by the department? When will this study be completed?

Answer: Using final data for the heating season collected by the Energy Information Administration (EIA), the long-term being prepared by EIA will update the analysis of prices for and the underlying market factors affecting heating fuel and related markets. In addition, it will examine the impact of the crisis on consumers and on industry finances. Completion of the study in early June is planned.

Question: Does this study include "an examination of potential collusive action by manufactures, dealers and distributors of home heating oil?"

Answer: The EIA study will present facts on prices, margins, and supplies of heating fuels for this past winter. It will examine the basic supply and demand and distribution factors underlying the rapid increase in heating oil prices in December, on both a national and regional basis. These general forces are the primary market determinants. EIA will deliver this study to the Federal Trade Commission, the Department of Justice, and the National Association of Attorneys General who are looking into possible anti-competitive behavior.

Question: Does this study include "an examination of the possibility that supplies of such fuel were restricted artificially to inflate prices?"

Answer: The EIA study will address various aspects of supply including production, inventories, and imports. High prices seen in December and January seem to be explained by the fundamental forces of supply and demand. With the exception of the brief period of refinery disruptions in late December, distillate production reached near record levels throughout much of December and January.

Question: Will this study include any specific recommendations: for example, the establishment or enhancement of programs to protect consumers in the future or new Federal authorities to enable the government to respond more effectively and efficiently to a situation of this nature?

Answer: While the EIA study may suggest ways to mitigate the effects of unforeseen weather such as that which occurred last December, it will be left to the policy-makers to develop recommendations and make decisions. However, the study will address mechanisms that exist for heating oil consumers and distributors to mitigate or hedge against the impact of unexpected market tightness.

Home Heating Oil

Question: Are there any laws, policies, executive orders, inter-agency agreements or other federal authorities in place today which could be used to mitigate the heating oil crisis experienced by the Northeast this past winter?

Answer: There are a number of Federal authorities available for use during different kinds of energy emergencies. In determining whether to invoke those authorities, however, it is necessary to consider whether the situation is serious enough to warrant their use, and whether the authorities available are appropriate for dealing with the situation.

With respect to the heating fuel supply dislocation that occurred last winter, it was determined that the problem of heating fuel supplies was transitory, and would be resolved by the market once additional supplies reached those regions of the country where an extraordinary demand was being placed on the available supplies. The Department judged that foreign and domestic supplies were sufficient to meet the demand, and acted to facilitate movements of those supplies in situations where bottlenecks were being experienced. For example, the Department supported the exercise of authority to grant "Jones Act" waivers in order to move heating oil and propane to the East Coast and New England on foreign-flag vessels. The Department also issued two emergency orders under section 3 of the Natural Gas Act authorizing increased imports of Canadian natural gas into Vermont and Massachusetts. Additionally, the Department worked with the Department of Transportation to give priority movement to oil tankers in congested harbors, and to rail cars containing propane. The Department of Transportation also granted waivers on hours of service restrictions for drivers of propane tank trucks.

Regional Products Reserves

Question: One suggestion a number of people have made, including myself, is the establishment of a regional products reserve. As you know, this subcommittee has been very generous when it comes to funding the crude oil reserve. We've spent about $19.7 billion to construct and fill the strategic reserve, so that the refineries can be stocked in case of shortage.

Don't you think it's fair to have a similar insurance policy for residential consumers, say a home heating oil products reserve in the northeast, to combat severe disruptions like the one experienced this winter?

Answer: Our analyses since 1975, including our April 1989 report on the methods for expanding the size of the Strategic Petroleum Reserve (SPR), indicate that the SPR located in centralized Gulf Coast storage can provide cost-effective protection for all regions and non-contiguous areas in all but the most severe circumstances. Storing refined products on a regional basis would increase costs, reduce flexibility to respond to unanticipated emergencies, create operational complexities, raise security problems, and pose a greater threat of spills and environmental damage. Inevitably, storage of refined products in one area of the country will lead to demands for storage in other areas, thereby magnifying these problems.

In addition to the financial and technical problems of storing products, refined products must be rotated, implying that the Federal Government would be a regular market participant, buying and selling oil, and trying to get the best market prices. We do not believe that this type of intervention by the Federal Government in energy markets is warranted.

The Department further notes that the storage facilities for the full 750 million barrel SPR are completely finished, and that only some leaching of caverns remains to be done. Developing regional product storage implies the underutilization of already existing facilities. The redundancy of these facilities would be very expensive because of the very high cost of above-ground steel tank storage compared with salt cavern storage.

Question: Will the "National Energy Strategy" that you are developing include recommendations with respect to regional products reserves? If not, can this issue be included at this date?

Answer: A number of participants in National Energy Strategy (NES) hearings suggested that regional product reserves (RPRs) be established. These recommendations were identified and listed in the NES Interim Report released in April 1990. The RPR issue will be included in the Department's analysis of NES options, which will be conducted during the next few months. It should be noted that previous studies of the RPR have concluded that regional product reserves would be very expensive and operationally complicated. The new DOE analysis will evaluate the costs of RPRs and weigh them against the benefits, taking into account current conditions in the petroleum product markets.

Question: Your testimony refers to the alternative financing study for the strategic reserve recently submitted by DOE. You mentioned the lease option concept ---- where the "federal government would obtain control over the oil in the S.P.R. but without necessarily bearing the full cost of outright purchase". Could this concept be applied to the establishment of a regional products reserve?

Answer: The legislation which the Department of Energy was required to draft as part of the SPR Alternative Financing Study expressly provides that "leased" oil might serve as a Regional Petroleum Reserve. Section 175(b) of Exhibit A to Chapter VI of Volume I, at page VI-113, provides that "leased" oil counted as part of the SPR, "if otherwise eligible, [shall] qualify to satisfy any applicable provisions for Regional Petroleum Reserves or noncontiguous storage..." However, this financing approach is more practical for crude oil than for refined products, and the SPR already has developed sufficient storage facilities for a 750 million barrel crude oil Reserve.

It is unlikely that the economic opportunity exists to make such a refined product "lease" viable. The crude oil "leasing" concept is especially attractive because there are some producers of crude oil which have excess capacity and their marginal costs of producing oil are much lower than the market price. Those oil producers may be willing to "lease" oil to the United States because they can get a financial return from their oil without affecting the world supply and demand balance. Refiners are not in the same situation. If the United States were to "lease" refined product rather than crude oil, the cost of the value added by refining presumably would have to be paid for by the Department as the "lessee", which lessens any potential savings. Furthermore, in order to get low cost oil, the "lessor" would have to be an integrated producer/refiner, so that the number of potential "lessors" would be reduced dramatically. Also, long term leases may not be compatible with product storage because of the need to prevent degradation of stored products over time.

In addition, the use of the Reserve could then become a serious issue for the potential "lessors", who might be concerned that the "leased" product would be used as a tool for controlling price fluctuations, rather than as a true emergency Reserve. In fact, it appears that some advocates of a regional product reserve system do intend that the Reserve would be used for intervention in the market on a non-emergency basis. In such an atmosphere it is highly unlikely that the United States could find a "lessor" willing to enter into a refined product contract, at a price attractive to us as the "lessee".

Low-Income Weatherization

Question: I am disappointed that your budget does not reflect a request for low-income weatherization grants. I've heard the arguments year after year that the overcharge monies will cover the absence of direct Federal appropriations, but now the well has run dry in many States. Some reports indicate that a vast majority of States have no Exxon funds or stripper well funds to commit to weatherization. Is that correct?

Answer: In addition to the Federal appropriation requested to support weatherization activities in FY 1991, the Petroleum Violation Escrow (PVE) funds will remain a stable source of support for State and Local Assistance Programs for several years. As of the end of FY 1989, the States had not yet expended more than half of the funds they have received. In every one of the 50 States, the amount of funds that remains unexpended exceeds the total of their program grants in the current fiscal year, and in all but two States, the amount remaining is twice the total of their program grants. Furthermore the consent order with Texaco provides that the States will receive $340 million plus accrued interest in payments over the next 4 years. Other oil overcharge cases are still to be decided. You should be aware that the States had allocated more than $680 million of their PVE receipts to the Weatherization Assistance Program. It is likely that, as new overcharge funds are disbursed to the States, they will continue weatherization activities in accordance with their energy priorities.

Question: More importantly the need has not diminished. The waiting list in some communities is 2 to 4 years. Nationwide, can you tell us how many units have been weatherized out of the eligible population?

Answer: Of approximately 22 million households currently eligible for weatherization assistance, over 4 million have been weatherized using DOE/WAP, PVE, or LIHEAP funds.

Question: Finally, considering the amount this Department spends to subsidize profit-making industries, (like the Clean Coal program), don't you think we ought to provide the resources necessary to lessen the energy burden on low-income Americans?

Answer: From FY 1977 through FY 1990, approximately $2.3 billion has been appropriated by the Congress for the DOE Weatherization Assistance Program. Of this amount, about $2.2 billion was allocated to States to implement their individual programs. States reported to DOE that as of September 30, 1989, a total of $678.4 million of PVE funds has been allocated by them for use in the Weatherization Assistance Program. These funds represent a significant commitment toward lessening the energy burden on low-income persons.

OIL IMPORT TAX

Question: Here's a loaded question. In your testimony, you list as a major theme the reduction of our dependence on imported oil. That's a laudable goal, but I'm concerned about the forms that theme may take. Can I safely assume, considering the President's ironclad pledge of "no new taxes," that this theme does NOT take the form of an oil import tax? What disadvantages do you see in the imposition of a tax on imported oil?

Answer: As part of the process of developing a National Energy Strategy, the Department of Energy is examining a broad range of energy policy options including several prospective forms of energy taxation. Our intention is to recommend to the President only those measures that offer the greatest net benefits. Until we complete our analysis I cannot tell you which measures will survive our scrutiny. As part of this analysis both potential costs and benefits will be studied.

An energy tax or fee, by raising energy prices, would be intended to encourage conservation and increased efficiency and, consequently, contribute to our energy security and environmental goals. A fee on imports of crude oil and refined products targets petroleum imports and provides some encouragement to domestic energy production, thus enhancing energy security goals. By reducing use of all petroleum products, it also has favorable environmental effects. But there are drawbacks. Based on our preliminary analysis, an oil import fee would appear to impose a disproportionate burden on low-income households. It would also penalize regions, industries, and households that are most heavily dependent on petroleum rather than other fuels. It would, for example, place a large burden on the Northeast, which uses petroleum for home heating and electric power generation. An import fee would also present trade difficulties in terms of how, for example, to treat Canada and other western hemisphere suppliers. If they were exempted from the fee, they would be able to supply a substantial portion of the U.S. market, thereby making the fee largely ineffective.

Clean Coal Technology

Question: The primary justification for spending billions on the Clean Coal program was the development of new, cleaner burning coal technologies in time for enactment of acid rain control legislation. Is that still the justification for this program?

Answer: No, the Clean Coal Technology Demonstration Program plays a much broader role in the National Energy Strategy than acid rain emissions control. The Department continues to believe that the technologies being developed in the Program will play an essential role in achieving the emissions reduction goals of Phase I and II of the proposed Clean Air Act. However, it is equally important that these Clean Coal Technologies be developed so that coal continues to be a viable source of energy for the Nation. The continued use of coal in an environmentally responsive manner is an essential component of a solution to many of the energy related problems that face the utility and industrial sectors of the Nation.

Question: If that's the case, I'm concerned that the fruits of this program won't be available in time to help with acid rain deadlines, especially considering the track record of the program. For example, from FY 86 through FY 90, the Congress, at the Administration's insistence, appropriated $2.747 billion for the Clean Coal Program. We've only spent about $81 million, and by the end of FY 90, we'll have spent a total of only $266 million. That's only 8 percent of the total in five years. In fact, the first round, funded in FY 86 , hasn't even finalized all the contractors. To me, there's no way these projects will be marketable in time to help with acid rain deadlines, so do we really need such enormous spending?

--Would you support a rescission of some of these funds to reduce the deficit in the outyears?

--How about a transfer to cover the costs of a supplemental for low income energy assistance?

Answer: We oppose any redirection or alternate use of the funds appropriated for the Clean Coal Technology Demonstration Program. We believe that the program as it is now being implemented not only can have a significant impact on the emissions reduction goals established for Phase I and Phase II of the proposed amendments to the Clean Air Act, but is vitally important to energy options being considered in the National Energy Strategy. We also point out that while Congress has appropriated the full amount of funding for the program (i.e., $2.747 billion), it has made available to the Department of Energy only $1.192 billion of this amount through FY 1990. Congress has appropriated $1.45 billion for CCT I through CCT

III. A portion of these funds have been allocated by Congress for SBIR and Program Direction. In addition, the Department selected 38 projects from Rounds I through III. It should be noted, also, that the comparatively small level of expenditures projected through 1990 (i.e., your figure of $266 million) is not unexpected. Most of these projects are in the design stage which is performed at a comparatively small cost. These costs will escalate sharply, however, with the start of construction.

You should also be aware that the Department expects all remaining CCT-I and II projects to be negotiated by July 31, 1990, and all CCT-III projects will be negotiated by December 31, 1990. By the end of the year (first quarter of FY 1991), the Department expects to have 38 Cooperative Agreements executed with a total cost to the Government of over $1.3 billion.

QUESTIONS SUBMITTED BY CONGRESSMAN RALPH REGULA

Energy Policy General

Question: Mr. Secretary, increasingly the energy policy debate is dominated by the question of to what extent environmental considerations should effect energy development. What are your views on this issues?

Answer: I agree with your assessment that environmental issues are playing a larger role in the discussion of energy development. Environmental protection, energy security, and economic growth are all strongly supported by the American people and this Administration. At the same time, however, we cannot allow the pursuit of any one of these objectives to overwhelm the other two. Without adequate, affordable energy supplies, our economy will be crippled and our citizens will suffer. Without a health economy, we will not generate the investment capital we need to replace older technology with newer, more efficient, less polluting technology.

Technology development, which is a key DOE mission, holds the key to achieving energy objectives, in an environmentally and economically compatible way. The principal vehicle for defining technology development programs and policies which balance energy and environmental objectives is the National Energy Strategy currently under development.

Energy Policy General

Question: As you know, the Nation's dependence on imported oil rose to a record high in January, 54 percent. And for the first time since 1977 imports exceeded nine million barrels a day. Production is at the lowest level in a quarter century and continuing to decline. There are worrisome statistics and more worrisome because having focused on these import and production statistics in recent years, I have watched with increasing alarm the trend toward greater imports and decreasing domestic production. What is your reaction and what are your plans for addressing the situation?

Answer: The Administration shares your concern about the Nation's increasing reliance on imported oil. When the President directed the Secretary of Energy to lead the development of a National Energy Strategy, he said: "we must balance -- achieve balance -- our increasing need for energy at reasonable prices, our commitment to a safer and healthier environment, our determination to maintain an economy that is second to none, and our goal to reduce dependence by ourselves and our friends and allies on potentially unreliable energy suppliers."

As you know, we have over the last decade acted to reduce our vulnerability to oil supply disruptions. With the staunch support of the Congress, we now have a large Strategic Petroleum Reserve that is growing toward a 750 million barrel target level. Other major oil consuming nations also have developed large, government-controlled stockpiles of oil. In addition, a number of OPEC nations have made substantial investments in refining facilities in consuming countries. These refining investments make it less likely to be in the interest of OPEC to cause a disruption in crude oil supplies.

To enhance U.S. energy security, we are examining a number of options within the context of the National Energy Strategy. The options include Federal and State incentives for domestic oil and gas production; removing statutory and regulatory barriers to increased use of natural gas; encouraging further gains in conservation and energy efficiency; pursuing cost-effective alternative fuels for transportation; and supporting research and development programs for domestic energy sources, including renewables and enhanced oil recovery techniques.

The Department has recently delivered to Congress a reoriented oil and gas research initiative that focuses on extending the productive life of domestic resources. The oil research program includes a near-term effort to expand the use of known economic technology to the largest possible portion of the domestic resource. This will produce additional reserves and insure future access to the resource for application of advanced technology developed in the mid-term part of the program. The gas research program is targeted at increasing recovery from known conventional reservoirs and improving the economic viability of unconventional gas resources.

Clean Air Act

Question: Mr. Secretary, last year in the context of discussing impending Clean Air Act reforms, we discussed your Department working with the State Public Utility Commissions. Last year you indicated this was an area you would be pursuing aggressively. What has and should be done in this area and do you need and have you sought any additional authority to deal with the utility commissions?

Answer: With respect to coordination with the Commissions regarding the Clean Coal Technology Program, the Deputy Assistant Secretary for Coal Technology (DASOCT) has addressed various committees of the National Association of Regulatory Utility Commissioners (NARUC) three times in the last 15 months. His presentations discussed the interrelationships between clean coal technologies and Clean Air Act amendments. The DASOCT has also worked with the Southern States Energy Board (SSEB), which represents the Governors of 17 southern and southeastern states. He and his staff have addressed three SSEB sponsored meetings, meetings at which regulators were present or represented, and have met with individual state utility commissions to discuss matters specific to their states. In addition, the Deputy Under Secretary for Policy, Planning and Analysis met with the NARUC Electricity Committee in November to discuss with them how the National Energy Strategy (NES) is being developed and the electricity issues being considered in the NES.

Finally, DOE's Least Cost Utility Planning Program, administered by the Office of Conservation and Renewable Energy, is working with the NARUC to access and support state efforts to develop integrated resource planning.

DOE believes no additional authorities are needed in order to work constructively with the commissions.

Question: Recently DOE did an analysis for me concerning technological approaches to reducing acid rain emissions which concluded that most of the 493 affected coal power plants would opt for fuel switching in the short term. The analysis went on to say that regardless of the options selected, some electricity intensive industrial consumers may find that the price of electricity renders their activities uncompetitive. This would seem to me to be a serious concern and one which should concern this Administration. What is your reaction?

Answer: The acid rain provisions in H.R. 3030 are not without cost. EPA has estimated that the average increase in utility rates due to these provisions will be about 2%[1/]. Such an increase in a company's energy costs should not significantly impact its competitiveness. However, some states are projected to have somewhat greater increases in electricity costs than the national average. For example, EPA calculated increases of 5.8% in Indiana, 4.8% in Kentucky, 5.9% in Ohio, 6.6% in Missouri, and 7.1% in West Virginia.

Rate increase estimates by the electric utility industry itself have exceeded EPA's estimates. For example, the Edison Electric Institute estimated that rates to industrial consumers would increase by more than 12% in Indiana, Missouri, Ohio, and West Virginia[2]. EEI projected a range of possible cost impacts, the highest statewide impact on industrial consumers was 22.7% in Missouri. It should be noted that these are average rate increases for a state and that potential rate increases for specific utilities will vary.

The Department has not attempted to quantify how rates such as those identified above will impact electricity intensive industries. The state public utility commissions (PUCs) will be responsible for allocating costs among various categories of electricity consumers, and DOE is not in a position to second guess the PUCs.

President Bush recognized the potential cost impacts of acid rain legislation when he formulated the Administration's proposal to reduce emissions by 10 million tons per year by the year 2000. The market-oriented approach embodied in H.R. 3030 was formulated to reduce economic impacts to the extent possible, consistent with achieving the desired level of emission reduction. The Department fully supports the President's decision to move aggressively to reduce emissions contributing to acid rain, in order to protect our environment.

[1] Economic Analysis of Title V (Acid Rain Provisions) of the Administration's Proposed Clean Air Act Amendments. Table A-8, ICF Resources, Inc. (for EPA), 9/89.

[2] Economic Evaluation of H.R. 3030...Title V, the Acid Rain Control Program, Temple Barker & Sloane, Inc. (for EEI), 8/89.

Question: I have serious concerns about the impact of proposed acid rain legislation on the Clean Coal program. I am concerned that the compliance deadlines in all of the pending proposals would preclude the use of new clean coal technologies. Would you comment on this?

Answer: Admittedly, the deadlines are tight but we believe they are workable in terms of having Clean Coal Technologies play a role in meeting Clean Air Act legislation targets.

The request by industry for more time must be balanced against environmental concerns and the impacts associated with delay. The Administration's proposed Clean Air legislation is an attempt to balance these energy and environmental considerations. Also, the Clean Coal Technology Program is not only intended to impact the immediate targets represented by phases 1 and 2, it must develop the technologies that will satisfy both future economic growth (and related energy demand), and emission levels consistent with the cap established by the Clean Air Act legislation.

Question: As you know, Congressman Sharp's substitute amendment to Title V of the Clean Air Act was adopted by the Committee, one provision of which would restrict the use of available Clean Coal funds to only those owners or operators of affected sources subject to the Phase I reduction requirements. I have serious concerns that this provision could effectively kill the Clean Coal program, because those affected by the Phase I reduction requirements will not be able to afford to both comply with the law and participate in the Clean Coal program. What is your reaction and what if anything is DOE doing to address this problem?

Answer: The Department opposes the Sharp provision that is contained in the Clean Air Act amendments recently accepted by the House Energy and Commerce Committee. It is believed that this provision would alter fundamentally the character and purpose of the Clean Coal Technology (CCT) Program. Rather than serve as a national program for the demonstration of pioneering technologies that will help the nation use its abundant reserves of coal well into the future, the CCT program would become merely a way to have U.S. taxpayers subsidize the cleanup of plants owned by 63 utilities in as few as 21 states.

The Department is working actively with members of key Congressional Committees to have this provision eliminated or modified into an acceptable form.

Question: Is it accurate to say that the Clean Coal program is already supporting a large number of projects located in those states where affected sources will be found?

Answer: Yes. Of the 38 projects selected, 28 are located in those States with affected sources.

Question: Given the constraints that the acid rain bill will impose on the clean coal program wouldn't it be wise to keep the program open to the widest range of participants in an effort to insure that the widest range of technologies are demonstrated?

Answer: It is essential to have the widest possible participation if the Clean Coal Technology (CCT) program is to remain a national program responsive to industry's needs for technology options to meet Clean Air legislation requirements and future energy needs under legislated emission caps. That is why there is concern over the Sharp Amendment to Clean Air legislation which would restrict participation to only 64 utility companies in 21 states, essentially excluding 29 states and 80 percent of the U.S. utility companies. Furthermore, the Sharp Amendment would bias the CCT program toward the nearer term retrofit technologies and away from repowering technologies. This is of deep concern because it is the repowering technologies that will be needed to meet post year 2000 electric power generation demands in the face of emission caps established by Clean Air legislation and growing concerns over potential global climate change. Repowering technologies offer increased power (50-150%), very low emissions (up to 95% NO_x and 98% SO_2 reduction), and high efficiency (40-48%) which translates to reduced CO_2 emissions. Also, non-utilities would be excluded under the Sharp Amendment. This would preclude furthering technologies that could have major impacts on local and regional pollution (e.g., the steel industry); and technologies that could mitigate dependence on foreign oil by introducing coal in the industrial sector (e.g., coal/water slurry fuels and advanced combustors).

Clean Coal

Question: There has been some discussion about delaying the fourth Clean Coal solicitation now scheduled for June. What is your reaction to this?

Answer: On May 15, 1990, the Department announced that it had decided to delay issuing its fourth call for proposals in the Clean Coal Technology Program. This decision recognizes that a number of unresolved issues exist in the pending Supplemental Appropriation Act and the Clean Air Act Amendment that make it premature for the Energy Department to begin asking industry for new clean coal technology proposals.

Question: There has been some discussion of possible changes in the fourth Clean Coal solicitation with respect to foreign participation and repayment provisions. I would preface my remarks by saying that I am a believer in the old adage that "if it ain't broke, don't fix it". As you are probably aware, the repayment provisions that are currently in effect in the third solicitation were a product of our experiences from the earlier rounds. Given the current pace of acid rain legislation, it is even more imperative that we get these clean coal technologies on stream and not delay the process. The changes I understand you are considering would put a chill on the participants and, in my view, needlessly delay the commercialization of these technologies. Would you care to comment on your rationale for changing a program that would appear to be working?

Answer: This question has been addressed in meetings between Department representatives and Committee staff. DOE discussed alternative approaches being investigated for repayment and foreign participation in the round four solicitation. No decision had been reached regarding the options proposed and DOE is considering views of the Committee staff. DOE is investigating alternatives to round three, because of the increased certainty (due to legislation) of a market for any economically successful demonstration technologies. New repayment approaches are being considered in light of the changing market and as a result of negotiation experience obtained with Round II projects since the issuance of PON III. These experiences indicate that unintended results may occur under the PON III repayment approach that do not comply with the overall plan for repayment. In addition, comments from the Public Hearing in Boston, Massachusetts, on the upcoming Round IV indicate that some prospective participants desire greater flexibility in negotiating repayment plans. Alternative repayment approaches would increase the number of participants subject to the repayment provisions without unduly burdening any participant.

The alternative approaches would not, in our view, place a chill on participation in the program. However, based on Supplemental Appropriations Conference language, if signed into law, the Department will leave the repayment provisions for Round 4 the same as for Round 3.

The changes regarding foreign involvement were to provide the opportunity for U.S. fabrication and engineering for a foreign technology that was only available through a single licensor. If there are multiple licensors for the technology, U.S. fabricators and engineering firms are provided a fair opportunity to compete.

Question: What is the existing policy with respect to foreign participation in DOE funded projects other than clean coal?

Answer: This is a very broad and complex issue, entering into every activity of the Department's programs and laboratories. On the one hand, the DOE has a responsibility to promote international cooperation for free and open exchange of basic scientific information in fields of international importance such as high energy physics, global climate studies, or human genome research. On the other hand, the DOE programs and laboratories generate intellectual property in a variety of disciplines that has potential commercial value and that could enhance U.S. industrial competitiveness.

As the largest single market in the world and the recognized leader in basic research and development, the U.S. continues to attract significant foreign interest in both our markets and our technologies. At the same time, our foreign competitors are rapidly catching up in terms of market size and R&D investment. The developments in Eastern Europe and the rapid economic growth of many developing countries offer significant opportunities for U.S. firms and technologies. Many technologies that are of interest to the U.S. market (such as some clean coal technologies) were developed and are owned by foreign firms.

With the increasing globalization of the marketplace in a wide range of industries, it is becoming increasingly difficult to define a "U.S. firm". High costs of capital in the U.S. are encouraging many traditional firms to seek foreign investment, either direct or through joint ventures. Further, many of the so-called "U.S. firms" are truly multi-national, with significant manufacturing facilities abroad.

As a result, the DOE policy with respect to foreign participation is a flexible response to these issues. We carefully evaluate each program to seek the type of participation, both foreign and domestic, that will help us achieve our national goals in energy, environment, and economic growth.

o We continue to encourage international cooperation in basic scientific research, including exchange of scientific personnel.

o We encourage DOE and laboratory inventors, as well as cost-sharing industrial partners, to seek patents and other intellectual property protection on information and technologies with potential commercial value.

o We seek to license Federally-funded technology to firms, regardless of country of ownership, that will commit to substantial U.S. manufacture or other significant benefits to the U.S., such as access to critical foreign technologies, access to foreign markets, or some reasonable recovery of U.S. investment in that technology.

It is very important that we achieve a BALANCE in our policies that respects the principles of free markets and free trade while enhancing U.S. industrial competitiveness. This is a difficult balance to achieve. Consequently, we work closely with other Federal agencies (including the U.S. Trade Representative, the Department of Commerce, and the Treasury Department) and with members of Congress to continually evaluate and improve our policies and procedures in this critically important area.

Question: Last November, we discussed the potential implications of applying a recent EPA decision, the "WEPCO" decision, to the Clean Coal program. As I think you agree, application of the "WEPCO" decision to projects demonstrating clean coal technologies could cause many current projects to be abandoned by utility participants, a potentially devastating blow to the Clean Coal program. What is the Administration's position with respect to applying the "WEPCO" decision to clean coal demonstrations?

Answer: The Department believes that the clean coal technology (CCT) demonstration projects should not be subject to Prevention of Significant Deterioration (PSD) preconstruction review and New Source Performance Standards (NSPS) requirements. If the threat of such application represented by the WEPCO decision is not removed, not only will the Program have fewer participants in future solicitations, but some utilities now in the program will withdraw. The Department is working both with EPA and the Congress to find a permanent, long-range solution to the problem.

Outer Continental Shelf

Question: Mr. Secretary, you served on the President's Task Force on Outer Continental Shelf oil and gas leasing. You have also been holding hearings on a National Energy Strategy, so you brought a unique perspective to the Task Force. For the past nine years through this committee, a vast amount of highly perspective [promising] offshore oil and gas areas have been put off limits to development. What role do you see our offshore oil and gas resources playing in our energy mix?

Answer: The outer continental shelf (OCS) of the United States currently provides about 11 percent of our total domestic oil production and 22 percent of our natural gas production. In addition, the United States Geological Survey (USGS) and the Minerals Management Service (MMS) estimate that combined state and federal OCS areas hold a substantial amount of undiscovered, economically recoverable oil and gas, ranging from 4 to 14 billion barrels of oil and from 44 to 114 trillion cubic feet of natural gas. These figures represent 38 percent of the nation's undiscovered recoverable oil and 39 percent of our undiscovered recoverable natural gas resources. By comparison, total proven U.S. reserves total 27 billion barrels of oil and 168 trillion cubic feet of natural gas.

Since the U.S. will continue to rely heavily on oil and natural gas well into the next century and offshore oil and gas resources comprise such a significant portion of the Nation's oil and gas endowment, these resources have a potentially vital role to play in the Nation's energy future.

Question: If we are to rely on these resources, how do you suggest we break the current impasse over offshore leasing?

Answer: Although the oil and gas industry has an excellent safety record with regard to environmental consequences of OCS oil and gas production, we can further minimize the risk of adverse environmental impacts of OCS oil and gas development. The collection of data on a broad range of environmental impacts must be improved. New technology and procedures can be utilized to further minimize oil spill risk. In addition, the industry must continue to improve its oil spill cleanup procedures.

Two other elements are necessary:

(1) Decisions on leasing should be based on a comprehensive record that includes a peer-reviewed analysis of environmental and socioeconomic impacts.

(2) State and local communities should be provided with greater opportunities for involvement in the OCS program, and with more stake in the success of the OCS program.

Southwestern Public Service Company

Question: Is it accurate that a comprehensive Environmental Information Volume was prepared through the NEPA process and based on this information an Environmental Assessment was made with an accompanying Finding of No Significant Impact (FONSI)?

Answer: An Environmental Assessment was prepared by DOE based on information provided by the applicant, Southwestern Public Service Corporation in an Environmental Information Volume, and was circulated to the public. A proposed Finding of No Significant Impact was published in the Federal Register on December 15, 1989, for public review and comment.

Question: Did EPA support the FONSI?

Answer: The letter received from EPA Region 6, dated January 16, 1990, did not take a position on the project or the FONSI. It did, however, indicate support for the Innovative Clean Coal Technology program and its goals.

Question: Did the only negative comments come from Washington, D.C. environmental groups?

Answer: There were four commentors that commented that an EIS was required to comply with the National Environmental Policy Act. All were from Washington, D.C. environmental groups (Trout Unlimited, National Wildlife Federation, National Resource Defense Council, and the Wildlife Society).

Question: Were favorable comments received from the region where the project would be located?

Answer: Comments received from the region where the project would be located were generally supportive.

Question: What did the Programmatic Impact Statement estimate the overall nationwide SO2 emissions reductions to be from maximum deployment of this technology?

Answer: The Programmatic Environmental Impact Statement estimated a 44% reduction in SO2 nationwide from maximum deployment of the atmospheric fluidized bed combustion technology.

Question: Has Southwestern Public Service Company indicated they will withdraw the project if required to do an EIS?

Answer: The Southwestern Public Service Company indicated by letter dated August 3, 1989, and subsequent discussions that they would withdraw in the event that an Environmental Impact Statement is required to satisfy National Environmental Policy Act compliance.

On April 13, 1990, the Department notified the Southwest Public Service Co. that it will require an EIS for the project as part of the NEPA process. No reply has been received as yet that would indicate any final action to be taken by them.

Question: Would this project be the first commercial scale Circulating Fluidized Bed?

Answer: This would be the first demonstration of circulating atmospheric fluidized bed combustion (CAFB) at a scale (250 MW) commensurate with making a major market penetration into the utility sector. Currently, under the Clean Coal Technology Program, Colorado-Ute Electric Association is operating a 110 MW CAFB (at present the largest in operation). The CUEA project has stimulated other utility projects at comparable scale. The utility industry is awaiting a similar data base at the 250 MW scale before proceeding.

Question: Did the Clean Coal Technology program envision certain situations where a project might produce initial but slight increases in emissions as part of the effort to achieve the longer term goal of the program?

Answer: The Clean Coal Technology Program did envision, and did not preclude, the possibility of a demonstration that might produce initial but slight increases in emissions in order to meet the longer term goals of the program.

STRATEGIC PETROLEUM RESERVE

Question: The Administration has asked Congress for authority to negotiate leasing agreements on crude oil to continue to fill the Strategic Petroleum Reserve. According to your Report to the Congress on Alternative Financing Methods for the Strategic Petroleum Reserve the Department has held discussions with several Middle Eastern oil producing countries, as well as with Norway, Mexico and the U.K., while "less detailed" discussions were held with Venezuela. Don't you believe that the potential advantages of such an arrangement with Venezuela -- to both of our countries -- deserve at least as much consideration as a leasing arrangement with the Middle East?

Answer: The Department shares your general views about the potential mutual benefits of cooperation with Western Hemisphere oil producing nations. The Department intends to hold the same kind of discussions concerning SPR leasing with Venezuela that were held with Middle East producers, and with Norway, Mexico and the U.K. The Department is interested in exploring possible oil leasing arrangements for SPR with all interested producers.

When we recounted the results of the joint State Department and Department of Energy international consultations in our recent report to the Congress, we sought to qualify our comments by differentiating between those countries with whom we had held more extensive exploratory discussions on SPR alternative financing from those with whom our contact, as of the date of the study, had been more limited. This differentiation was never intended to reflect a difference in policy toward any of those countries. In addition, discussions conducted as part of the Financing Study represented initial international consultations, and the Department is continuing to pursue a number of steps which must be completed prior to actual lease negotiations.

While Congress is in the process of acting on the authorizing legislation, the Department will continue to conduct certain preparatory activities, included development of negotiating plans and additional exploratory discussions. In particular, the Department has been working to arrange bilateral discussions involving representatives of the Venezuelan Government and Petroleos de Venezuela (PDVSA), the State-owned oil company. These consultations are now tentatively scheduled to be held in Washington in June 1990, pending confirmation from the Venezuelan Ministry.

National Energy Strategy

Question: In directing you to develop a comprehensive National Energy Strategy, the President cited as one goal the need to "reduce dependence by ourselves and our friends and allies on potentially unreliable energy suppliers." What are your thoughts as to how we achieve this goal?

Answer: Recognizing the integrated nature of the world oil market, the United States must continue to pursue an internationally oriented energy policy with its allies in the Organization for Economic Cooperation and Development (OECD). As discussed in our answer to a previous questions, the United States has developed a large Strategic Petroleum Reserve (SPR) as insurance against oil supply disruptions. OECD allies have followed the U.S. lead, particularly in Germany and Japan.

We are exploring initiatives to enhance domestic production, including renewables; to improve fuel energy efficiency; and to encourage the use of alternative fuels. The President already has forwarded to the Congress a set of tax proposals intended to mitigate the downward trend in domestic production, and additional incentives for domestic oil and gas production are being examined in the process of National Energy Strategy development.

Question: I understand that you have indicated that energy efficiency will be a dominant theme in the National Energy Strategy your Department is currently preparing. In fact most of the accounts in the press I have read have focused on the conservation element of the strategy. I agree with your assessment that we can do a better job in terms of conservation, but wouldn't you agree that conservation alone is not an energy strategy? Energy conservation and alternative energy sources hold the prospect for merely affecting the growth of petroleum imports--not replacing them. Mustn't we also pursue increased domestic production, alternative fuels, clean coal technologies, etc., along with conservation measures?

Answer: There is no question that we will need to vigorously pursue all of our energy options. That includes those on the supply side as well as those on the demand side. We believe there are substantial untapped opportunities for conservation in every sector. These measures often carry a bonus in terms of reduced environmental impact. To the extent these conservation measures are competitive with supply side options, it makes good sense to pursue them first.

We will, however, need to concurrently pursue development of new energy supplies, particularly expanded electricity capacity, and increased production of domestic fuels.

MONDAY, MAY 14, 1990.

ENERGY CONSERVATION

WITNESSES

J. MICHAEL DAVIS, ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY

B. REID DETCHON, PRINCIPAL DEPUTY ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY

ALAN J. STREB, DEPUTY ASSISTANT SECRETARY FOR INDUSTRIAL TECHNOLOGIES

FRANK M. STEWART, JR., DEPUTY ASSISTANT SECRETARY FOR TECHNICAL AND FINANCIAL ASSISTANCE

ALBERT A. CHESNES, DEPUTY ASSISTANT SECRETARY FOR TRANSPORTATION TECHNOLOGIES

JOHN P. MILLHONE, DEPUTY ASSISTANT SECRETARY FOR BUILDINGS TECHNOLOGIES

Mr. YATES. This is the hearing on the appropriations for fiscal year 1991 for the Department of Energy, Energy Conservation. Appearing in support of that appropriation is Mr. J. Michael Davis, Assistant Secretary for Conservation and Renewable Energy and he is accompanied by Mr. Detchon. Mr. Detchon, it is good to see you, Principal Deputy Assistant Secretary for Conservation and Renewable Energy.

Mr. Streb, Deputy Assistant Secretary for Industrial Technologies. Mr. Stewart, Deputy Assistant Secretary for Technical and Financial Assistance. Mr. Chesnes, Deputy Assistant Secretary for Transportation Technologies. Mr. Millhone, Deputy Assistant Secretary for Building Technology. Is that everybody?

Okay.

Mr. Davis' statement may go into the record at this point to be followed by the biographies of Mr. Detchon, Mr. Chesnes, and Mr. Millhone.

[The information follows:]

Statement of J. Michael Davis
Assistant Secretary, Conservation and Renewable Energy
U.S. Department of Energy

Committee on Appropriations
Subcommittee on Interior and Related Agencies
U.S. House of Representatives

Mr. Chairman and members of the Committee:

I appreciate the opportunity to present the Administration's FY 1991 budget request of $212.6 million for Energy Conservation -- my first such opportunity before this Subcommittee since becoming Assistant Secretary. I am bringing to you an R&D request that reflects the renewed commitment this Administration is giving to energy efficiency research and development as an integral part of our National Energy Strategy.

We are currently in the midst of developing that strategy, through a process of listening to the public in every part of this country -- a painstaking process that began last spring and that will continue through December of this year. An interim report, based on the extensive public input we have received, was published earlier this month and will be the subject of public review and comment through the spring and summer months.

Once completed, the National Energy Strategy will be an action plan that lays out specific actions we need to take, as a Department and a Nation, over the near-, mid-, and long-term, to secure the energy we need for a prosperous and growing economy.

The exact dimensions of that plan are not yet clear; however, we do know that there will be an increased emphasis on the role of energy efficiency in meeting the Nation's future energy needs. The consensus favoring energy efficiency as a critical piece of our National Energy Strategy has been overwhelming, and that fact is reflected in the budget proposal before you today.

You may note that I speak of energy efficiency and not of conservation. The reason for that is simple: To me, the word "conservation" implies doing without -- getting by with less heat, less light, less comfort -- and that is not our objective. Our objective is to provide all the heat, light, and comfort that we require and to use less energy in the process -- and that means energy efficiency.

Fifteen years ago, it was thought implausible and even impossible to separate energy use from economic growth. Since then, the performance of our economy has confounded the skeptics. Today, we use about seven percent more energy than we did in 1973, but we power an economy that is nearly 50 percent larger. We have 20 million more homes today, yet residential energy consumption is up less than five percent. We have 50 million more vehicles on the road, but new cars are almost 90 percent more fuel-efficient than pre-1973 models. The cumulative energy savings we have achieved represent a gift to ourselves of over $900 billion since 1973. And yet the price of energy for American consumers remains far below the price paid in most other countries in the world.

Despite those gains -- and because of what we have learned since then -- it is just as clear today as it was in 1973 that energy efficiency has not reached its full potential and that large opportunities for further progress still remain. We face a need, over the next 10 years, for an additional 100,000 megawatts or more of electrical capacity alone -- not to mention growth in petroleum demand. Vigorous implementation at the Federal, State, and local levels of economically attractive advanced technology in energy efficiency could reduce that need by one quarter to one half. Such an effort would have an energy benefit -- by reducing the need for new power plants and their associated costs to consumers; an economic benefit -- by increasing our productivity per unit of energy, improving our international competitiveness and our standard of living; and an environmental benefit -- by reducing the atmospheric emissions associated with power production.

The budget request before you today is more than double the amount requested for FY 1990 in conservation research and development. We have listened to the views of experts around the nation, we have analyzed the contribution that energy efficiency has made to economic productivity, and we have responded with a renewed commitment to these programs. This is a budget which is attentive to future market needs and opportunities; which is responsive to energy, economic, and environmental goals; which is balanced by end use and time frame of delivery; and which will serve as a catalyst for progress in the private sector.

This request should be viewed as a foundation for the programs and policies which we expect to emerge from the National Energy Strategy. In January, we announced a series of initiatives that we are beginning with FY 1990 funds to focus our R&D effort on our highest priority projects; Deputy Secretary Henson Moore described them as building blocks of the National Energy Strategy.

Let me take a moment to highlight our initiatives in energy efficiency:

o **Relighting Federal Facilities** -- The Federal government offers substantial opportunities for energy savings; it should be a leader in adopting new technology. We propose to form "energy efficiency teams" of engineers and design specialists, from both the public and private sectors, to audit certain targeted Federal buildings for retrofit with today's more efficient lighting technologies -- technologies that can reduce lighting costs by 25 percent or more. Where possible, we will encourage utilities to participate as partners, benefiting from the energy savings that are achieved and reducing the cost to the government.

We hope in turn to use these examples to encourage retrofits of other Federal facilities and of commercial and industrial lighting in the private sector. A 25 percent saving in lighting costs -- which we hope to achieve by the year 2000 -- would mean energy savings of hundreds of millions of dollars annually to the Federal government and $5 billion to the private sector.

o **Integrated Resource Planning** -- This effort, begun several years ago as Least-Cost Utility Planning, is aimed at allowing energy efficiency investments to compete on a level playing field with conventional sources of energy supply. That means making it as profitable for utilities to reduce the demand for power -- for example, through incentives to consumers to use more efficient appliances -- as to build new capacity. Our investment in this program -- which involves working with the States and the Federal Energy Regulatory Commission to develop appropriate regulatory treatment of energy efficiency measures -- will be repaid many times over if the need for just one large power plant can be eliminated... and we expect many times that level of success.

Indeed, I would highlight this initiative as a counter to those who would equate the level of Federal spending on conservation with the success achieved: What counts is not just what you spend; it's how you spend it. Improving the return on utility investments in energy efficiency will have a far greater impact on the actual implementation of such measures than almost anything we might do in the laboratory.

o **Building Code Improvement** -- Building standards developed by DOE are mandatory for Federal facilities but voluntary for the private sector. Adoption of such standards would lead to a 25 percent improvement in the energy efficiency of new buildings -- buildings that will be using power for the next 50 to 75 years. We intend to encourage State and local governments, the regulatory authorities in this area, to adopt these model codes, and we will work with architects, engineers, and home builders to facilitate their use.

o **Energy Efficiency Engineering Centers** -- Our Energy Analysis and Diagnostic Center program operates at 13 engineering schools, giving students and faculty hands-on experience in performing energy audits of small and medium-sized manufacturers. A Federal investment of $11 million has yielded energy savings with a total value of $355 million; we propose to expand the program by three schools this year and three more in 1991.

The cost of all our initiatives in energy efficiency, including others in commercial lighting and the safe combustion of municipal waste, is modest -- $5 million in FY 1990, building on a program base of $8.4 million. In FY 1991 we are increasing the program base to $10.1 million and asking $8 million on top of that.

Now let me touch briefly on our major program areas:

o We are providing a substantial increase to our **Office of Buildings and Community Systems**. Our request of nearly $46 million is triple the level requested last year and 19 percent above the congressional appropriation. Our initiatives in lighting, building codes, and integrated resource planning fall within this area. In addition, we are integrating in this Office responsibilities previously assigned to the Solar Buildings program under

Renewable Energy.

This Office also has the responsibility for supporting joint ventures in the areas of factory-made housing and advanced district cooling, as provided by S. 488, enacted as Public Law 101-218 in December -- the Renewable Energy and Energy Efficiency Technology Competitiveness Act of 1989. We are working now to develop an implementation plan for this legislation and to ensure that we have the information we need to proceed with confidence.

o Our $40 million request for the **Office of Industrial Programs** is two and a half times our request last year, but is $10 million below the congressional appropriation. This reduction is largely due to the one-time funding spike caused last year by the ramp-up of the Metals Initiative.

o Similarly, the **Office of Transportation Systems**, at $56.6 million, is almost double last year's request but approximately $8 million below the appropriation. Here the difference is due to two decisions -- to request funding for only one automotive gas turbine team, and to narrow our development process to the three most promising battery couples for electric vehicles.

The turbine decision was a hard one, affecting a successful program of R&D; but we concluded that we need only one development path to meet our research objective, which is proof of concept. Therefore, we propose to put our two industrial partners into competition for the funding, based on the level of cost sharing available: We will either support one effort at the current cost-sharing level or continue both paths if the level of cost sharing is increased.

I might add that this decision, together with the reduced funding needs of the Metals Initiative, more than accounts for the difference between last year's appropriation for conservation R&D and this year's request. Indeed, I would strongly suggest that we are proposing not just a steady-state budget, but one that will produce more results by proceeding in a more focused way.

For example, in the case of battery development for electric vehicles, we concluded that we were diffusing our research effort over too many options and decided to concentrate on zinc-bromine, sodium-sulfur, and lithium-metal sulfide as the couples most likely to succeed.

o In the multi-sector **Office of Energy Utilization Research**, we are asking $32 million -- a one-third increase over last year's request, but $4 million below the congressional appropriation. The reduction is caused by a scaling down of materials investigations in this basic research area as the results are picked up within the applied research programs in Industry and Transportation -- exactly the supportive process that we expect to occur in this program of cross-cutting fundamental research.

o Finally, let me turn to our **State and Local Assistance Programs**, for which we are asking $30 million. We are committed to the continuation and revitalization of State energy conservation and weatherization efforts, and our budget request, as I will explain, supports that.

In recent years, the States have received more than three and a half billion dollars in restitutionary funds from petroleum overcharge violations; more than half of these funds remain unexpended. In every one of the 50 States, the amount of funds that remains unexpended exceeds the total of their program grants in the current fiscal year, and in all but two States, the amount remaining is twice the total of their program grants.

We have budgeted enough for Program Direction to manage a program funded at current levels, but we have chosen to leave to the States the level of resources that they wish to commit. Our staff will continue to work with the States to provide technical assistance as the States continue to develop and implement their energy conservation programs. We will also continue to work with the States to assure that oil overcharge funds are expended in accordance with the provisions of the court settlements.

In addition to the funds requested for program direction, we are proposing to make available $15 million in grants to encourage innovative approaches in weatherization assistance, particularly in attracting non-Federal resources to the program. Attracting such funds, as for example through utility programs developed through an integrated resource planning process, will strengthen the long-term vitality of the program. In addition, we are undertaking a major evaluation of the size and persistence of the energy savings achieved by the program. The results could contribute significantly to improving the program's effectiveness.

Mr. Chairman, in conclusion, we are proposing a balanced yet aggressive program in energy conservation, and we have some very exciting initiatives under way. We are redirecting our program to play the key role it deserves in our emerging National Energy Strategy, and together with our program in renewable energy, we are investing in critical components of our energy future.

We have tried to assess the relative benefit of these varied components and fund them accordingly, by end use and by time frame. We will continue to improve our understanding of relative benefit with each succeeding year. Your support in providing the flexibility needed to manage the program, both in terms of prescribed personnel levels and funding constraints, is critical in this regard.

I appreciate your time and attention, and I would be pleased at this time to answer any questions you may have.

Thank you very much.

U.S. Department of Energy
Office of Scheduling
Washington, D.C 20585
[illegible]

BIOGRAPHY

B. REID DETCHON

Reid Detchon is the Principal Deputy Assistant Secretary for Conservation and Renewable Energy, U.S. Department of Energy (DOE). He has held this position since April, 1989.

The Office of Conservation and Renewable Energy performs research and development in energy efficiency and alternative energy sources for vehicles, buildings and industry, including solar energy, photovoltaics, wind, geothermal and biomass technologies. The Office also is responsible for administering grant programs for weatherization assistance and state energy planning.

Previously to serving as Principal Deputy Assistant Secretary, Detchon led DOE's transition team for the President-elect. In the 1988 presidential campaign, he worked as a speechwriter for Vice President Bush. From 1987 until 1988, he served as Assistant for Communications to the Vice President.

Detchon also spent five years with Senator John C. Danforth (R-MO), serving first on the Senate Committee on Government Affairs staff and later as the Senator's legislative director, with a particular concentration on energy and environmental issues.

A 1970 graduate of Yale University, where he majored in American studies, Detchon worked as a sportswriter for the Baltimore Evening Sun and as a reporter and Washington correspondent for the Columbia Daily Tribune in Missouri. In 1979, he was named "Washington Correspondent of the Year" by the National Press Club.

Detchon lives in the Washington suburb of Bethesda, Maryland, with his wife and three children.

July 1989

Department of Energy
Washington, DC 20585

Albert A. Chesnes
Acting Deputy Assistant Secretary
for Transportation Technologies
Conservation and Renewable Energy
Department of Energy

Biographical Sketch

Mr. Chesnes has been responsible for management of a wide range of technology research and development activities in the area of advanced transportation propulsion systems and related energy conservation projects since the Department was formed in 1977. In his new position, his responsibilities will include technology development and industrial implementation of advanced heat engine and electric/hybrid propulsion systems, alternative fuels utilization and biofuels production, and advanced materials for transportation applications.

Before joining the government in 1977, Mr. Chesnes has held a number of management positions with industrial organizations including Grumman Aircraft Corporation, Raytheon Company, and Westinghouse Electric Corporation. He is a graduate of Columbia University, and presently resides with his wife in Fort Washington, Maryland.

Department of Energy
Washington, DC 20585

JOHN P. MILLHONE

U.S. Department of Energy

John P. Millhone was named Deputy Assistant Secretary for Building Technologies of the U.S. Department of Energy in April 1990. He previously was Director of the DOE Office of Buildings and Community Systems, a position he had held since 1979.

In his position, he is responsible for three offices, the Office of Building Energy Research (OBER), the Office of Codes and Standards (OCS), and the Office of Federal Energy Management Programs (OFEMP). OBER conducts research on the development and commercialization of advanced energy efficiency and renewable energy technologies applicable to buildings. OCS is responsible for the national Building Energy Standards and Guidelines and Appliance Standards programs. OFEMP monitors the energy use and provides technical assistance to all Federal departments and agencies.

Mr. Millhone is cochair of the interagency Committee on Indoor Air Quality that coordinates the indoor air quality planning and research of 15 Federal agencies. He is former chairman of the International Energy Agency's End Use Working Party, which coordinates energy efficiency research activities among the IEA countries.

Before joining DOE, he was the director of the Minnesota Energy Agency (1975-79) and the director of the Iowa Energy Policy Council (1974-75). During this period, he was staff director of the Energy Conservation Subcommittee of the National Governors Association. He also served as a member and chairman of DOE's Fuel Oil Marketing Advisory Committee.

He is a frequent speaker on energy efficiency subjects and has presented numerous papers on energy conservation, research management, and indoor air quality.

His early experience was in journalism, specializing in energy and environmental subjects. He worked for the Associated Press, Detroit Free Press and Des Moines Register and Tribune. He received his bachelor of journalism degree from the University of Missouri and has done graduate work in law and political science.

ENERGY CONSERVATION BUDGET

Mr. YATES. Mr. Davis, what is the state of energy conservation. Is it good, bad, or indifferent? Should we be doing more than we are doing? Are we doing enough, in a nutshell?

Mr. DAVIS. Mr. Chairman, I think that the state is a good, healthy state. I think the programs are in a better position now in the Department to be more efficient than they have been in the past, and as we present our budget today and discuss it with you, I think you will see that we are certainly trying to find the relative value that these programs offer and budget for them appropriately.

Mr. YATES. Well, it looks like Buildings and Community Systems has a significant increase of $7.199 million. Industrial's suffered a whopping decrease of $10 million. Transportation also, that kind of surprises me, they had a big decrease of $8.3 million. The Multi-Sector had a decrease of $3.555, and facilities had a $4 million increase. Policy and Management is in there for a slight increase. You lost an enormous sum, $187.465 million for weatherization. Is weatherization no longer a need?

Mr. DAVIS. No, sir, it is needed. I am prepared to explain what our strategy was.

Mr. YATES. All right. Tell us your strategy.

Mr. DAVIS. Maybe I should address all the areas that you ticked off. I believe we have made a good request in buildings. You noted the increase over prior year appropriations there. In the industrial program, the largest amount of decrease is the difference between what was appropriated in fiscal year 1990 for the Metals Initiative and what we requested in fiscal year 1991. We requested $8.6 million in fiscal year 1991. We can get into the detail of why we think that is sufficient to cover the metals program.

Mr. YATES. What do you lose when you lose the $10 million?

METALS INITIATIVE

Mr. DAVIS. There was a major incremental increase in funding in fiscal year 1990 for the Metals Initiative. In 1991 we have requested $8.6 million. But going back to the prior years, you have appropriated about $30 million to the Metals Initiative program in total. Of that $30 million, we have about $26 million that we have actually obligated which leaves us a balance of just under $4 million.

The activities that we have planned in fiscal year 1991 will consume about $7.4 million. With prior year money and with the amount of additional money we have in 1991, we will have a balance of about $5 million for activities beyond what we currently are funding.

So we do have some additional money in that program to look at new opportunities, and we plan to look at new opportunities.

STEEL INITIATIVE

Mr. YATES. Why are you looking at new opportunities and leaving the steel initiative out?

Mr. DAVIS. I don't think we are.

Mr. YATES. Does your budget provide for the $7.5 million in accordance with the request of the American Iron and Steel Institute?

Mr. DAVIS. I believe it does. The money that has been identified as necessary for superplastic steels, for spray casting and direct steelmaking I believe we have accounted for and requested.

Mr. YATES. You have covered the American Steel Institute's request, then. Do you need more funding for this?

Mr. DAVIS. It is possible that AISI put more money in its plan than we did. Our program plan and what we believe is necessary to continue these programs is identified in our budget.

Mr. YATES. How much will the Metals Initiative allow you to fund in the way of new projects? Any?

Mr. DAVIS. It will allow us from prior year monies about $4 million and from monies we have not identified requirements for in 1991, another $1.2. So we have roughly $5 million of money that we can apply to projects not yet identified in the program.

Mr. YATES. Not yet identified. You said you have $4 million from prior year appropriations. In what appropriations did you have this overage, do you know?

Mr. DAVIS. I believe primarily from fiscal year 1990. There was a big spike in fiscal calendar year 1990. I can check that, but it is $3.8 or $4 million in funds that are not committed at this time.

Mr. YATES. What did we put them in for? Do you know?

Mr. DAVIS. Maybe Al Streb can answer that question.

Mr. STREB. Mr. Chairman, in 1990 there was $16.9 million appropriated. The intent was to cover the projects that were already in place and to allow an appropriation for new projects. It was in the order of $3.9 or $4 million. Those funds now are being held in reserve pending the evaluation and selection of proposals that industry would put before us.

Again, the appropriation that we have asked for this year, which has a surplus of about $1.2 million, will give us about $5 million, as Mr. Davis was saying, to accommodate new projects. Based on what we have before us today, I would have to say that this is enough. New proposals are coming up all the time. It is difficult to assess how much could be needed.

NEW PROJECTS FOR METALS INITIATIVE

Mr. YATES. Are any of the new proposals worthy?

Mr. STREB. We have already selected and will soon be in the process of negotiating funds for an aluminum project. This will be the first aluminum project under the Metals Initiative. I believe that the commitment for the current year is on the order of $900,000. It still leaves us with a significant margin.

Mr. YATES. I don't understand, Mr. Streb. In response to a question by staff on the metals initiatives, for fiscal 1991 you say this—$8.6 million has been requested in the fiscal year 1991 budget. These funds will cover completion of phase one of the spray casting project and continuation of the direct steel making project.

In direct steel making you have $6 million rather than $7.5 million.

Mr. STREB. Correct.

Mr. YATES. I thought the Secretary had said that the amount of money available was $7.5 million. Did I misunderstand your answer?

Mr. DAVIS. Maybe I misunderstood the question. We requested $6 million for direct steelmaking. It is possible the American Iron and Steel Institute made a request for $7.5 million. But I am not aware of that.

Mr. YATES. You were not aware that they had requested $7.5 million?

Mr. DAVIS. No, I am not.

Mr. YATES. Is it possible that the amount of their request is more appropriate than $6 million? Did you know about it, Mr. Streb?

Mr. STREB. No, sir, I did not. I would have to say that we did believe that $6 million was sufficient for 1991 to continue that project.

As a matter of fact, the data that we are working with would indicate that that $6 million plus another $400,000 in 1992 would complete the program as it was proposed to us by the American Iron and Steel Institute.

CONTINUATION OF PROJECTS

Mr. YATES. Then you go on to say this. "$1.4 million would be used for initiation of phase two spray casting project, and initiation and phase two-B of the super plastic steel projects. Do you have enough money to do both of those?

Mr. STREB. These are options that are proposed. We are not in a position at this point in time to know for certain whether we want to proceed into phase two of the spray casting projects or phase 2-B of the super plastic steel project.

Mr. YATES. Well, what is your guess?

Mr. STREB. I am always hopeful for success, which would mean that at some point late in the year we may need some additional funding. I would hope that the $1.4 million that we have set aside for those potential outcomes would be sufficient to support our needs and keep the projects running smoothly.

Mr. YATES. Is the hope based on experience?

Mr. STREB. The Hope is based on experience, yes, sir.

Mr. YATES. What was it Dr. Johnson said about the news of his friend's second marriage, do you remember? It is the triumph of hope over experience. Is your hope going to triumph or will your experience triumph?

Mr. STREB. I believe we have sufficient funds to continue an orderly program.

Mr. YATES. Suppose you don't have, what then?

Mr. DAVIS. Mr. Chairman, let me take that one on.

Mr. YATES. Should the Committee put extra money in to cover a possible contingency and how much should it put in?

Mr. DAVIS. Sir, I would request that in fiscal year 1991 we stay with our request. In fiscal year 1991 we have identified $7.4 million to continue programs. If it is necessary to increase that amount, certainly we would do that.

I would like to say that the opportunity that direct steel-making offers, as well as those activities that get us closer to net shape casting, which substantially reduces the amount of energy needed to form steel, are quite important and will certainly get a priority in my point of view. It is a legitimate question, whether we have requested enough in 1991. I think we have.

PLANS FOR FY 1992

Mr. YATES. If I remember earlier testimony when the Admiral was in, almost every one of your activities pointed to 1992 as being the year when everything came to fruition. 1991 is not going to be a banner year for you, is it? It is kind of a holding operation.

Mr. DAVIS. In our request in 1991, really there were two things we tried to accomplish. We tried to broaden the view and point out that indeed there are other activities in addition to research that are fundamentally important in the area of energy efficiency. So we are looking at not just the longer term thinking but mid-term and near-term activities.

We feel we have made major progress in the building sector. But we are trying throughout the entire conservation budget to establish what we refer to as the relative benefit of each of these activities, one activity relative to another, where do you spend your next dollar? We are also trying to look carefully at what we can do, not in just a single year to recover, but also over a period of time, that forces us to look at the 1992 budget.

STEEL INITIATIVE

Mr. YATES. What is the state of the steel program, is the steel industry innovatively developing new ideas?

Mr. STREB. This program has been very successful in pulling industries together. We are very pleased in particular with the one project on direct steelmaking which involves basically the entire industry as represented through the American Iron and Steel Institute. Of course, we are a participant to a substantial extent.

Just evidenced from that one project, the industry is very interested in innovation. They are also active participants in the other two projects.

Mr. YATES. So you ought to participate as fully as possible as long as you have such excellent cooperation in industry, shouldn't you? Is the amount of money you have in here indicative of that kind of cooperation?

Mr. STREB. For 1991 we believe we have sufficient funds.

Mr. YATES. But you are looking forward to 1992, having more funds?

Mr. STREB. It may be necessary.

CONTINUOUS FIBER CERAMIC COMPOSITES

Mr. YATES. Let's talk about ceramics. What is the status of the plan related to continuous fiber ceramic composite research?

Mr. DAVIS. That plan was to be delivered on the 1st of May.

Mr. YATES. You don't have the plan now?

Mr. DAVIS. No, sir. It has not completed clearance within the Department. We have cleared it for Departmental review. We expect to have it up here about the 15th of June.

Mr. YATES. We would hope we could have it in time for our mark up. Is there any way we can get a draft so that we can be in a position to help you achieve the goals in it?

Mr. Davis. If it is possible to do that, we certainly will. I would add further, we probably have roughly $2 million identified in our 1991 request that would relate very, very directly to what the industry put forward as their plan.

The identification of funding requirements in the plan occurred after we had put our 1991 budget forward.

Mr. Yates. Is there any industrial interest in this?

Mr. Davis. I believe there is significant industrial interest.

Mr. Yates. What markets would be the target for this technology?

Mr. Davis. I think right now the large markets are the transportation sector, in terms of operating at higher temperature, and also the industrial sector in the form of vessels and heat exchangers, which again allow you to operate at higher temperature, which produces higher throughput and is important to corrosion and maintenance associated with industrial processes.

JAPANESE EFFORTS IN CERAMICS

Mr. Yates. Are you in a position to tell the committee how our progress in this endeavor compares with that of the Japanese?

Mr. Davis. There are numbers that would suggest in the applications area that the Japanese are spending substantially more than we are. The general view I have been able to gain that we may be slightly in the lead in terms of our technology and research base. From an applications point of view there seems to be no question but that the Japanese, as well as the European community, are investing more than we are investing.

Mr. Yates. Usually there is a relationship between progress and the amount you invest, correct?

Mr. Davis. Yes.

Mr. Yates. Should we be investing more?

Mr. Davis. Overall in our programs, in the aggregate, we have a $25 million investment requested in ceramic materials of one sort or another.

The continuous fiber ceramic composite initiative is a focus within that. I think one of the things we have to come to grips with is how our $2 million request compares with the $6.5 million which has been identified by industry as needed for the first year of their plan in continuous fiber ceramic composites.

How that additional $4.5 million relates to the other $25 million we are already investing with industry is an important question. It is not clear to me exactly what the priorities are, but the $25 million needs to be looked at relative to the additional $6.5 million.

FOREIGN COMPETITION IN CERAMICS

Mr. Yates. How does the amount we have put up for the programs compare with the amounts the Europeans and the Japanese have put up? How much more are they putting up?

Mr. Davis. If my numbers are correct, the Japanese effort is probably twice ours.

Mr. Yates. You mean $50 million.

Mr. Davis. Yes, on that order.

Mr. Yates. How much for the Europeans?

Mr. DAVIS. I have some numbers if I could find them to respond to that in detail. It is certainly more than our effort.

[The information follows:]

EUROPEAN COMMUNITY'S INVESTMENT IN CERAMIC COMPOSITES

A recent assessment of foreign countries' investment in R&D on ceramic composites indicates that the major countries in the European Community (West Germany, France, United Kingdom and Sweden) are expending a combined total of $97,000,000 per year in research on ceramic composites, divided between governments ($71 million) and the private sector ($26 million).

Mr. YATES. How far ahead of them are we in technology? Because of their expenditures, can they overcome our lead?

Mr. DAVIS. I think they can gain access to the market faster than we can because they appear to be making a large investment in applications; in other words, taking the technology base and figuring out how to apply it even to the point where they may not be as interested in making money initially, but in fact, gaining a market share and building on that market share as a way of furthering product development.

So I think we have to realize that we are the largest market in the world and we are going to have to be more aggressive in protecting our own markets rather than establishing a beachhead in international markets.

Mr. YATES. Why don't you ask for enough money to do that?

Mr. DAVIS. This is one where I will simply say we closed up our 1991 budget before we took a full view.

Mr. YATES. It is not a question of how much money do you want. How much more money does our country's well being need in order to stay ahead in the position we find ourselves in now? This is an important field, isn't it?

Mr. DAVIS. Yes, it is.

Mr. YATES. We should be doing everything we can to stay ahead of the competition, shouldn't we?

Mr. DAVIS. I would agree. I would defer to industry in terms of what they identified as not just their best interests but the country's best interests.

Mr. YATES. How much money do you need?

Mr. DAVIS. If we were to move ahead with the plan put forward by industry, that is another $4.5 million on top of our budget.

Mr. YATES. If the committee put $4.5 million in, does that make up the difference or should you ask for more than the $4.5 million?

Mr. DAVIS. I think the $4.5 million would make up the difference between our request and the 1991 plan by industry.

Mr. YATES. Should we be pulling industry along a little faster?

Mr. DAVIS. The process that they went through in looking at opportunities and preparing a report was, I think, comprehensive. At this point in time I certainly would not second guess that.

Mr. YATES. You know to one who is not as experienced in the field as you, you see this as kind of a sprint at the moment between the United States, the Japanese and the Europeans. We are carrying weight if we don't put the money in to allow us to keep up in the sprint with them.

If industry says this is enough, do we have to worry about the Japanese invading those industries with their products because of the additional money they have? Are we likely to lose whatever connections we have with industry as a result of competitive advantages the Japanese and Europeans have since they have more money?

I know I am asking you to look at a crystal ball but it is important that we try to find the answers.

FOREIGN ACQUISITION OF ENERGY TECHNOLOGY

Mr. DAVIS. I think there is that question and then another question. There is substantial foreign investment acquiring what one might say is our industrial base in this area.

There have been a number of what started out as American companies in this technology that are now owned by our international competitors. So, as fast it seems as we can develop the technology base, that is being recognized, and those companies are being purchased by foreign interests.

Mr. YATES. Now are those companies that we were in cooperation with advancing the state of the art?

Mr. DAVIS. I believe Norton is an example, a corporation that was recently purchased by a French firm.

Mr. YATES. Why don't you put something in the contract that gives the United States the right to meet any competitive bids? Shouldn't we be doing that?

Mr. DAVIS. That is certainly an excellent point. Again, I would have to respond with some procurement expertise that I don't have as to whether or not we can build that in.

Mr. YATES. Shouldn't we be doing that and shouldn't we be taking steps to permit us to do that? Does this require additional legislation? Is there something we ought to put in our bill that would enable them to do it?

I get uneasy when I hear that the French are buying a company like the Norton Company which you say is one of the state-of-the-art companies. It gives them a boost as a result of our putting money in. We were cooperating with the Norton Company. With our help they advanced the state-of-the-art. The French came in and took advantage of it. They had a quantum leap forward as a result of that.

Mr. DAVIS. Apparently, in those agreements there is a provision that manufacturing would reside in the United States, that they would maintain Norton as an entity here. Those items sold in the U.S. would be manufactured in the U.S. But those as far as I can tell, are assertions. Whether that is actually what comes to pass is unknown at this time.

Mr. YATES. What do you have to do in order to provide us with the information we need to protect the country against incursions of that type? Do you have to talk to your lawyers? Do you have to talk to anybody else in order to prepare appropriate legislative provisions that would enable you to do it?

Mr. DAVIS. Yes, sir, we would. That is a topic already under substantial discussion within the Department of Energy as to how we procure things and what provisions we put into those procurements in terms of intellectual rights, patents, royalties, et cetera.

Throughout the Department we are spending a great deal more time figuring out how to maintain the investment of U.S. tax dollars and U.S. interest.

It is a topic that has to be given substantial effort.

Mr. YATES. How close are you to reaching any kind of a conclusion as to what you should be doing?

Mr. DAVIS. I will have to inquire further and respond.

Mr. YATES. The committee would ask you to take such steps as are necessary to put you into that kind of position. You recognize what I am saying when I say "that kind of position". Not only with respect to legislative provisions that might be appropriate but also with respect to appropriate allocation of funding that might be necessary.

It is kind of a cushion to enable you to operate fairly rapidly.

Mr. DAVIS. Yes, sir.

Mr. YATES. Do you think we could get that before our mark up?

Mr. DAVIS. I think we can certainly share with you what actions have been taken already within the Department and those actions that are at least under consideration. We will try to bring those forward.

[The information follows:]

LEGISLATIVE PROVISIONS FOR U.S. FIRMS PURCHASED BY FOREIGN ENTITIES

There are legal safeguards to protect technologies when foreign entities purchase U.S. firms that have technologies with national security implications or that fall under Export Control regulations. In addition, DOE includes contract provisions for assuring that firms can utilize technologies developed with DOE support, provided that manufacturing occurs in the U.S. for sales in the U.S. Where the potential exists for foreign purchasers to buy companies which are performing DOE contracted research and development, contracts in some circumstances require the company to license the technology to U.S. firms for production.

Mr. YATES. Can you supply for the record the advantages gained by the French when they bought the Norton Company?

Mr. DAVIS. We will provide that for the record.

[The information follows:]

ADVANTAGES GAINED BY THE FRENCH IN PURCHASING NORTON

The foreign purchase of several of the best U.S.-based ceramic companies is a disconcerting aspect of our efforts to establish a ceramic technology base in the U.S. for the manufacture of reliable and cost-effective ceramic engine components. The Norton Company has been for many years a leading producer of silicon nitride, silicon carbide, and zirconia-toughened ceramics. Moreover, Norton has utilized the technology developed under DOE contract work for improved processing of transformation-toughened ceramics and for joining ceramics to produce and market a wide variety of products, including pump and valve components, knives, and wear parts for machinery. Presumably, the French Compagnie de St. Gobain considered both the ceramic technology expertise and the market experience of Norton when they decided to purchase the company.

Mr. YATES. Who beside the French and Japanese? I assume the Germans are in this. Are the British in it too?

Mr. DAVIS. The Germans are involved. The European countries primarily are France, Britain, Germany, and then there are other minor players, but those are the key European countries.

Mr. **Yates**. Please place in the record a table that shows our investment this year and the investment made by the other countries in advancing the state-of-the-art to their own advantage.

Mr. **Davis**.

[The information follows:]

U.S. VS. FOREIGN INVESTMENT IN CERAMIC COMPOSITE MATERIALS

Foreign government investment in ceramic composite materials (particulate, whisker, and continuous fiber) is more than double the U.S. government investment. An appraisal of foreign capabilities was recently made for the Office of Industrial Technologies (OIT). A summary of the foreign governmental support and an estimate of private support follows:

Ceramic Matrix Composites/Continuous Fiber Ceramic Composites
(Annual Funding in Millions of Dollars)

	Germany	France	Japan	Sweden	UK
Government	13.0/ 5.0	48.0/25.0	17.0/ 5.0	3.5/ 1.4	6.4/ 3.3
Private	4.0/ 1.0	17.0/ 7.0	33.0/10.0	1.5/ 0.6	3.6/ 1.7
Totals	17.0/ 6.0	65.0/32.0	50.0/15.0	5.0/ 2.0	10.0/ 5.0

It is France that has the strongest and best organized commitment to ceramic matrix composites (CMC) and continuous fiber ceramic composites (CFCC), the result of a deliberate national R&D effort planned in the late 1970s and fueled by their commitment to an ambitious space and aircraft program (including Concorde, Ariane, and Aerobus). Government funded agencies coordinate their efforts and deal with large players such as SEP, Aerospatiale, Rhone-Poulenc, and Pechiney.

In contrast to the aerospace and defense applications targeted by France, Japan is pursuing commercial and industrial applications. The Japanese are also the acknowledged world leaders in the development of ceramic fibers. A number of industry experts who reviewed the OIT appraisal considered this estimate of Japanese investment to be significantly understated. U.S. ceramic composite efforts were not included in the above survey, and we only have information from the Interagency Coordinating Committee on Structural Ceramics and the Energy Materials Coordinating Committee on Federal funding levels. The comparable U.S. Government funding for CMC/CFCC is $31.0/$21.6 million. Total foreign government funding for CMC/CFCC is $87.0/$40.0 million. It should be noted that the U.S. government funding estimate includes ceramic fiber development costs while the foreign government funding does not.

While U.S. industry investment is not known in total, we know from a survey of United States Advanced Ceramics Association (USACA) members that the ceramics industry invests substantially more of their own funds in R&D than they receive from the Federal government. We also know that substantial investments are being made by companies like Atlantic Research, Dow Corning, Corning Glass, Du Pont, Lanxide Corp., Textron, 3M, United Technologies, and Allied-Signal.

RELIGHTING FEDERAL BUILDINGS

Mr. YATES. Tell us about relighting federal buildings. I understand that we have made some progress in terms of energy saved through lighting. Is my understanding correct?

Mr. DAVIS. Yes, sir, it is correct.

Mr. YATES. That being true, can you tell us what the state is now or put into the record a description of what the state is?

Mr. DAVIS. Yes, sir.

Mr. YATES. Can you tell us what steps are being made to use our knowledge in that respect in that field, in the federal buildings or wherever it is necessary, wherever we can save money as a result of that in the operation of our various agencies?

Mr. DAVIS. Sir, there is technology available today that can increase lighting efficiency from 25 to 50 percent by application. Technology is available. The products are available. Replacing a ballast in a conventional fluorescent light will reduce energy consumption by about 25 percent.

Mr. YATES. What is a ballast?

Mr. DAVIS. The device that provides the power when the lamp is turned on. We have solid state ballasts that will reduce the amount of energy required to light that light by 25 percent. We also have better lights themselves. We also have better fixtures and reflectors. There are a number of steps one could take, the replacement of the ballast, the fixture, the light bulbs.

Mr. YATES. Is GSA doing that?

Mr. DAVIS. We are working with GSA as a main partner in the Relighting of Federal Buildings Initiative. We are going to provide the expertise and have a number of government and private sector engineers look at the Washington, D.C. area. We will provide the design expertise to go building by building. There will be some criteria for selecting those buildings, figure out what lighting retrofits can be done, and create the procurement document.

GSA has agreed to fund that retrofit with their own money, and they have a certain amount of funds set aside for retrofit activities. In the event they don't want to fund it, they would turn it over to, for instance, PEPCO, and PEPCO might consider funding it as part of a shared savings contract. What we see applying here would apply equally as well in private sector buildings, and the relationship between the owner of a private sector building and the particular servicing utility could be just the same as a relationship between GSA and the utilities servicing the federal sector.

So I think the approach will work in federal buildings as well as private buildings.

DEVELOPMENTS IN LIGHTING

Mr. YATES. Have the advances in lighting been achieved as a result of research programs initiated by the Federal Government?

Mr. DAVIS. I would say largely, yes.

Mr. YATES. Now here you have the ballast and the lighting fixture improvements that are going to be sold by private industry. Do we have any share of that? Private industry has been able to patent those?

Mr. **Davis**. I believe that is the case. I will check on those to see if it is any different.

Mr. **Yates**. What happens to the investment of the Federal Government? Is it just in the nature of contributions to advance the art or is there anything that we can do to recoup part of our investment?

Mr. **Davis**. I will answer part of that. Certainly, there is a return in terms of reduced energy costs. John Millhone may have some comment.

Mr. **Millhone**. The solid state ballast is an interesting success story that grew out of research in the 1970s at Lawrence Berkeley Laboratory.

Mr. **Yates**. Is that Professor Rosenburg?

Mr. **Millhone**. It was not his project. It was Sam Berman's work. A field test with work on a Navy facility proved the capability. As we went from the research into the applications area and had industrial partners, then we passed on the technology to the private firms that were doing work in this area. As part of their investment in the development of the commercial version they acquired the patent rights.

Mr. **Yates**. How did the commercial version differ from the version the research group was envisioning.

Mr. **Millhone**. It is, in part, the manufacturing technology to produce the product in large volume.

Mr. **Yates**. We put all the money up for the research and someone comes along and patents it and makes all the money out of it. Is there no way that we could protect the amount we invest in something like this so that we can get a return on it over a period of years?

Mr. **Millhone**. In the past the primary interest has been in getting the products introduced into the marketplace so we have not looked at acquiring a patent interest until somewhat recently.

Mr. **Yates**. Are these usually cost sharing projects? Was the ballast a cost sharing project?

Mr. **Millhone**. It became cost sharing when we got into demonstration. The early research was done totally by federal funds.

NEW WINDOW TECHNOLOGY

Mr. **Yates**. What about the question on windows? Is that a part of this, too, on energy savings, different kinds of windows?

Didn't I see something on television that showed advances in lighting, advances in window construction?

Mr. **Millhone**. The major advance has been low-Eglazing window panes to prevent the thermal heat from coming in but yet allow you to get the visual light through the window.

These can increase the thermal performance of a window immensely.

Mr. **Yates**. Do they do away with the need for thermal pane windows, for example?

Mr. **Millhone**. Yes, it would be a substitute for something of that sort. It would be built into the window itself and change the R value for single plane glass to R-3. Developments would include low-E glazing and also panes of glass with a gas between the panes.

Recent work has achieved an R-8 window which is eight times greater than original single-pane glass.

There have been major advances in this area. This has been the result of the work that we have supported over the years through the funding that your Committee and Congress have provided.

Mr. YATES. Over the budget. In other words the Committee did a good job.

Mr. MILLHONE. We all did a good job on that one.

Mr. YATES. Where else did we do a good job besides lights and windows? I am trying to get the story for the record.

Mr. MILLHONE. During the period of the 1980s when we focused on long-term generic type research, we did make progress in many building areas. I think it is that progress that now has led to the increase that you have seen in the request for 1991 in the buildings area, where we feel we have a number of these technologies that can be introduced and can make a difference.

Mr. YATES. How do you get the story on this? Is there anything in writing on this that could be put into the record that shows what happens as a result of the research programs?

Mr. MILLHONE. There is a publication of success stories that Mr. Davis has put out.

Mr. YATES. Would you make those available for our record, please?

Mr. DAVIS. Yes, sir.

[The information follows:]

ENERGY CONSERVATION SUCCESS STORIES

We have documented success stories relating to DOE-sponsored conservation technologies. Several reports have been supplied to the Committee which are a compedium of recent successes.

NEW CONSERVATION SUCCESS STORIES

The 32 success stories presented here reflect the diversity of the activities and projects implemented by the Office of Conservation. The range covers everything from district cooling projects to biodegradable plastics. Although many of these projects have been under development for some time, they were judged to have become successes or have yielded new energy-saving products or processes during the past year. Through their diversity, these projects provide a comprehensive approach to conserving energy in the U.S. economy.

Affordable Housing through Energy Conservation

Homebuilders were in need of a simple, reliable way to determine the cost-effectiveness of different energy conservation options for designing and constructing energy-efficient homes. A Guide has been developed by DOE that will allow homebuilders to optimize the selection of combinations of options, fuel choices, building material, and labor costs for any region of the U.S. The user can easily and accurately estimate the energy and dollar savings that will result from various improvements and how those savings compare with any increase the improvement would add to the price of a home. The *Affordable Housing Through Energy Conservation* guide, consisting of microcomputer diskettes and technical-support documents, comes in four parts: (1) PEAR, a user-friendly software program that estimates the reductions in energy use for selected design and construction options; (2) a handbook that explains how to specify, install, and operate the various combinations of design and construction options contained in the computer program; (3) a second computer diskette, on which the analysis will be stored, and a users manual with full instructions for its use in combination with the software program; and (4) a technical-support document that describes the database, operating assumptions, and algorithms used in the microcomputer program.

The database developed for the PEAR program has also been used in developing guidelines for the Federal Residential Standard for the design of Federally owned buildings and for proposed modifications to the residential portion of ANSI/ASHRAE/IES Standard 90A-1980.

Design/Compliance Tools Support Building Energy Conservation Standards

DOE has promulgated energy conservation standards for the design of new commercial and multi-family high-rise buildings. Compliance with these standards is mandatory only for the design of Federal buildings, but DOE has recommended that all design professionals voluntarily adopt the guidelines in designing energy-conserving buildings. Two microcomputer programs, ENVSTD™ and LTGSTD, were developed to facilitate the use of these standards. ENVSTD™ confirms that the building design meets the ENVelope criteria contained in the STanDards. This program also serves as a valuable design tool with which to assess the energy effects of a variety of window and wall design options. LTGSTD confirms that the building design meets the LighTinG criteria STanDards and serves as a valuable design tool in assessing the lighting needs of a building. Development of these computer programs was a team effort of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE); the Illuminating Engineering Society of North America (IESNA); and DOE. The volunteer members of the ASHRAE Standing Standards Project Committee 90R developed the computational algorithms used in the DOE standards, ASHRAE/IES Standard 90.1-1989, and in this program. The Pacific Northwest Laboratory (PNL) programmed these algorithms into user-friendly software. Both computer programs are helpful to architects, designers, and engineers who must analyze whether new building designs comply with the new DOE energy-conserving standards.

Passive Solar Design Strategies

Through the collaboration of the Passive Solar Industries Council (PSIC) and its member organizations, including the National Association of Home Builders (NAHB) and the Solar Energy Research Institute, over ten years of research on passive solar design have been packaged into a form useful to home builders, developers, and designers. The design strategy packages are site-specific and consists of guidelines and simplified calculation procedures. A computerized "expert system" version of the guidelines is currently being developed at the request of PSIC and NAHB. The Passive Solar Design Strategies package represents the first design tool to have the endorsement of NAHB's Standing Committee on Energy.

During the past year, PSIC and NAHB have initiated a series of workshops designed to assist builders, developers, and designers in using the guidelines package. These workshops follow articles and announcements regarding the availability of the design strategies in trade journals and other media.

Energy Kinetics Low Mass Purgeable Boiler

Conventional boilers used to heat homes lose a significant amount of energy when the burner shuts off and the energy remaining in the boiler water and the heat exchanger escapes out the flue pipe or chimney. The amount of this "off-period cycling loss" depends upon the weight of the heat exchanger and the temperature of the boiler water at the time of burner shut-off. DOE researchers at the Brookhaven National Laboratory (BNL) suggested a change in the boiler's fundamental design concept to overcome this energy loss, namely, to purge the hot water from the boiler into a reservoir of usable heat during the off-period. With support from DOE, the Energy Kinetics Corporation developed a prototype of a purgeable boiler with low mass, which was tested successfully at BNL in 1980.

The low mass boiler consists of a 10-foot long hollow section which is coiled and behaves as a heat-exchanger. Water flows internally and is warmed as hot combustion gases pass outside the coil on their way from the firebox to the exhaust stack. Water in the boiler flows counter to the flow of the hot gases, with the coolest water on the external loop, which minimizes the external jacket heat loss. The system uses a microprocessor control which purges all the heat remaining in the boiler and allows separate zones of the house to be heated. The purged heat is sent to either the last zone requiring heat or, when the thermostat is satisfied, to the water heater tank, which can be connected to receive heat from the boiler water. Because of the low volume of water in the boiler (less than three gallons), the boiler is able to reach the operating temperature in less than one minute and to purge stored heat at a rate of 30° F per minute. The boiler operates with a steady state efficiency of 83.3 percent, but more importantly, the purging mode has been found to increase cyclic (seasonal) efficiency of the boiler from 71.9 percent to 82.5 percent. Energy Kinetics has achieved a market penetration of about 2,000 units per year for its "System 2000" purgeable low-mass boiler.

Low-Cost Oil Burner Flame Analyzer

Oil-fired furnaces that are installed and used in homes usually operate at less than optimal efficiency. During installation and servicing, burners may have been improperly adjusted or calibrated. During use, soot accumulates on heat-exchanger surfaces, causing thermal performance to deteriorate two percent or more each year between "tune-ups." To improve furnace energy performance, DOE supported research at Brookhaven National Laboratory on development of an optical flame monitor that could be incorporated into a furnace. The monitor uses low-cost optical detectors and common electronic devices. With the combustion air detector set for the highest efficiency, a simple display indicates when the burner needs adjustment or servicing.

The oil-heat industry has responded positively to the monitor. Cooperative field evaluations are planned for the 1989-1990 heating season with funding support from the Canadian Mortgage and Housing Corporation. The next research stages will examine self-generated control of the burner's air/fuel ratio, allowing the burner to automatically compensate for seasonal variations in chimney draft as well as dust and lint accumulation on the air-inlet passages.

Miami District Cooling Project

Hospitals in the Civic Center Hospital Complex in Miami, Florida, sought to link their separate, primary, chilled-water plants through a common underground distribution system, thus realizing the energy savings associated with district cooling systems without incurring the high capital costs of installing new, centralized equipment. With a grant from DOE, a feasibility study for the *Hospital Chilled Water Loop Assessment-Miami District Cooling Project* was conducted by the Burns and Roe Company and the Joseph Technology Corporation. When a comparison was made between total electric consumption under the current operating conditions and under the district cooling alternative, the integrated loop realized a savings of approximately 15 percent.

It is estimated that the capital cost of new piping and mechanical room retrofits will be $3.5 million. However, this cost will be recovered in only six years through energy savings and reduced expenditures for operation and maintenance of the loop system.

Federal Methanol Fleet

DOE has sponsored a variety of alternative-fuel research initiatives aimed at reducing dependency on imported petroleum and simultaneously offering environmental benefits. One such promising alternative fuel is methanol. The Federal Methanol Fleet was established in 1985 to demonstrate the technological feasibility of methanol-fueled vehicles. The program is designed to assess the performance of these vehicles in such areas as fuel economy, emissions, and vehicle safety, as well as the cost of operation and maintenance in comparison to gasoline-fueled vehicles. The Federal Methanol Fleet of 39 vehicles (20 methanol- and 19 gasoline-fueled vehicles) is now being tested at Lawrence Berkeley Laboratory, Argonne National Laboratory, and Oak Ridge National Laboratory. All of the methanol vehicles are former gasoline vehicles retrofitted to operate on fuel methanol (which is a mixture of 85 percent methanol and 15 percent unleaded gasoline). During three years of successful operation of the program, fleet vehicles have logged more than 700,000 miles. Performance of the vehicles has been virtually trouble free, although energy consumption by the methanol-fueled cars has been slightly higher than that of the gasoline-fueled vehicles due to different driving cycles. Ratings by drivers have been very similar for the two types of fuel, and maintenance statistics also compare well between methanol and gasoline cars.

The project is viewed as highly successful in increasing prospects for the transfer of methanol-fueled vehicles into civilian fleet operations and in demonstrating methanol as a viable future substitute for imported petroleum products.

1989 SAE Methanol Marathon

DOE, in cooperation with the Society of Automotive Engineers (SAE) and other industry sponsors, has an ongoing program to sponsor student competitions to engineer and race methanol-fueled vehicles. The 1989 Methanol Marathon was held to foster the use of alternative fuels among engineering students. Student teams from 15 competing universities converted new

Chevrolet Corsicas, donated by General Motors, to run on a blend of 85 percent methanol and 15 percent gasoline. The competition included static tests and an 1,100 mile road rally run from Detroit, Michigan, to Washington, D.C. The work of students from the University of Tennessee was the overall winner and the University received $6,000 in prize money and the winner's trophy at a ceremony held at the U.S. Capitol. The winning car averaged 36.7 mpg (gasoline equivalent) over the road rally, representing a substantial improvement over the fuel economy normally achieved by gasoline-fueled cars.

As a result of the competition, more than 200 engineering students became more knowledgeable about an alternative transportation fuel, and national attention was focused on the potential of alternative fuels to assist the U.S. in becoming less dependent on imported petroleum.

Thermal Barrier Coatings

Diesel engines are needed that will provide greater fuel economy and improved emissions performance. DOE's Heavy Duty Transport Technology Program is supporting research to develop a technology base applicable to advanced, high-temperature diesel engines. One area of particular interest to DOE is the development of thick, thermal barrier coatings. When used in diesel truck engines, thermal barrier coatings improve fuel economy, increase engine power density, and reduce parasitic losses. To date, several applications of thermal barrier coatings have emerged from DOE-supported work. These coatings are being used on engine piston crowns to reduce heat loss and improve thermal fatigue life, and on exhaust valves in engines used for residual fuel operation.

The first diesel engine piston to incorporate thermal barrier coatings was recently designed. The piston incorporates a thick thermal barrier coating on the crown surface. The plasma-sprayed zirconia ceramic coatings, processes, and equipment developed in DOE's Heavy Duty Transport Program have also led to the development of a coating for marine and stationary engine applications. In these applications, the coating is applied to protect against corrosion and to extend valve life.

High-Temperature Liquid Lubricants

Lubricating oils that perform effectively in the harsh environments of high-temperature processes are considered major advances. The high-temperature liquid lubricants being developed under DOE's Heavy Duty Transport Technology Program will enable top ring reversal temperatures to be increased to nearly 500°C, more than double the capability of conventional lubricating oils. The new lubricants could also dramatically reduce particulate emissions; this is an important characteristic because recent data indicate that 30 to 60 percent of particulate emissions emanate from the lube oils currently in use. The new synthetic lubricant is being developed with an additive so that the oil will decompose cleanly, forming less soot and emitting fewer particulates. The new lubricants also have lower ash formation, which should contribute to a reduction in engine wear and emissions. Finally, the new oil has a viscosity characteristic that allows engine operation in a temperature range three times that of conventional oils. Conventional lube oils need viscosity improvers, which tend to break down and form deposits. Laboratory formulation of the lubricants has been completed and engine-testing began in late 1989.

High Temperature Materials Laboratory

DOE's High Temperature Materials Laboratory (HTML), located at Oak Ridge National Laboratory (ORNL), serves as a focal point for multidisciplinary research on new ceramics and metal alloys that show potential for high--temperature applications. Research activities at the HTML are designed to help solve high-temperature materials problems that now limit the efficiency and reliability of advanced energy-conversion systems. The HTML is a DOE User Facility and provides easy access to users from industry and academia. The Laboratory operates four User Centers: 1) Materials Analysis, 2) X-Ray Diffraction, 3) Physical Properties, and, 4) Mechanical Properties. Investments in instrumentation for these four User Centers represent about $6.5M or 34 percent of the total appropriations ($19.1M) for the facility.

Since the HTML became operational in June 1987, it has generated considerable interest within industry. The amount of User research carried out in the four User Centers has steadily increased since the first standard user agreement was signed in July 1987. By September 30, 1989, 27 universities, 24 industrial companies, and three government facilities had signed agreements to utilize the facility. During August 1989, Coors Ceramics Co., the nation's largest producer of precision technical ceramics, announced its decision to build a ceramics production plant in Oak Ridge, Tennessee. Proximity to the HTML and to the technology transfer opportunities from DOE's ceramic technology programs at ORNL were cited as major factors in the decision to locate in the area.

Advanced Invertor Technology

Vehicles that run on electricity are attractive transportation options because they minimize pollution and conserve liquid fuels. As part of DOE's efforts to improve these vehicles, research carried out under DOE's Electric Vehicle Propulsion System Technology Program has led to the introduction of an advanced invertor technology. The new invertor, developed in support of DOE's ETX-II R&D Program for vehicle propulsion applications, is greatly reduced in size and weight. Two technological advances central to the development of the advanced invertor are the Metal Oxide Semiconductor (MOS) Controlled Thyristor (MCT) power switch and high voltage multi-layer capacitors. These technologies give the invertor greater power efficiency and better thermal management, while reducing capacitor volume and heat loss.

The invertor technology and design concepts used in DOE's ETX Program led to the development of an invertor and control system for a diesel/electric drive motor for the radiator cooling fan. This system is being used to regulate the cooling fan speed for maintaining optimum engine operating temperature on a diesel/electric locomotive. The motor control and invertor are currently being field tested and are planned for production in 1990.

Gel-Casting

A method was needed to form ceramic materials into complex shapes at a high rate of production but at a relatively low cost. DOE research carried out under the Advanced Materials Development Program has led to the development of a novel gel-casting method for molding ceramic powders. Gel-casting overcomes the shortcomings of injection molding by separating the mold-filling operation from the setting operation, using a water-based vehicle instead of a 100-percent wax- or polymer-based vehicle. Gel-casting also uses a new setting mechanism that is generically different from current practice. The successful production of tensile and other alumina oxide ceramic specimens demonstrated the potential for gel-casting technology. The outcome of this fast and economical technique is predictable, and product dimensions may be controlled.

Collaborative research agreements are being initiated to develop this technique for the processing of high-performance silicon nitride. The gel-casting process for other ceramics has already been licensed to a major U.S. ceramics manufacturer.

Silicon Nitride Powder

New engine technologies will rely upon ceramic engine parts that are light in weight, experience little wear, extend the life of engines (particularly those of cars), and promote energy efficiency. Reliable and cost-effective ceramic components are sought for these advanced automotive heat engines and are a major focus of DOE's Advanced Materials Development Program (AMP). To date, their application has been limited by the inability to produce large volumes of quality material. Efforts under the AMP have therefore focused on improving ceramics processing techniques. Recently, DOE-supported research has led to the development of a patented technique for the production of high-quality silicon nitride powder for ceramic components. The process is based on the low-temperature reduction of silicon chloride with ammonia.

A pilot plant has been designed for this process and discussions have been held with several chemical companies regarding potential technology licensing for domestic production.

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Battery Combustion-Attenuation Material

All batteries based on aqueous systems emit hydrogen and oxygen, combustible gases that could cause the battery case to rupture if the gases were to ignite. Under DOE's Electric and Hybrid Vehicle Testing and Evaluation Program, research has led to the development of an inexpensive device for managing the combustible gases emitted from electric vehicle batteries. Specifically, a combustion-attenuation material has been designed for both basic and acidic electrolyte batteries; it acts by filling the open volume or headspace of the battery, preventing the battery case from rupturing if the gases within the battery cells should ignite during charging or operation of an electric vehicle. This device has been tested with nickel-iron battery modules, which evolve more gases than most batteries, and has demonstrated a clear reduction in the level of risk or damage from the ignition of combustible gases.

This technology has been patented and incorporated into the nickel-iron battery packs being designed for the dual-shaft electric propulsion (DSEP) system. The first commercial orders for batteries equipped with the combustion-attenuation materials have also been placed, and are for sealed lead-acid batteries to be used in emergency stand-by power generation equipment.

Hyperfiltration of Food

The concentration of liquids, particularly concentration of fruit and vegetable juices, is one of the most energy-intensive steps in the food-processing industry. Almost all concentrated juice made in the U.S. is produced using some type of evaporation process, in which water is removed from single-strength juice to yield a product that consists of 50 to 70 percent solid material. Membrane technology is also used to concentrate juices, using semi-permeable membranes to separate water from the solution. It was thus important to assess the energy-conserving potential of membrane technology for juice-concentration processes. DOE funded the National Food Processors Association (NFPA) to investigate the application of high-temperature hyperfiltration to food processing. The study focused on the use of thin film composites, a new class of membranes with several advantages over standard cellulose acetate membranes. They can withstand higher temperatures, operate within a wider Ph range, and have increased resistance to biological degradation. Membranes were tested in several configurations in selected, high-temperature, food-processing streams in order to characterize membrane performance as a function of time.

A prototype unit for tomato juice concentration was built and tested successfully at a commercial host site.

PET Bottle Separator

The increased use of plastics in recent decades has resulted in increased levels of plastic wastes at both the consumer level and the producer/fabricator level. Recycling efforts are complicated because different types of plastic wastes must be separated from one another before further processing can occur. The nature of plastics makes such separation a difficult procedure. For example, selective incineration is hampered by the thermal degradation of plastics at high temperatures, and flotation techniques cannot be employed in waste plastic separation processes because of the narrow range of densities of plastics. As part of a larger project to convert certain waste plastics to fuel oil, DOE and the Procedyne Corporation developed an innovative combination of separation processes for recycling polyethylene terephthalate (PET) beverage bottles. At a demonstration plant set up to use the processes, approximately 20 million pounds of bottles and cans were sorted out for recycling according to those made of PET, of high-density polyethylene, and of aluminum. The separator is currently being used at a Pepsi plant, where it is recycling 12 to 18 million pounds of PET annually.

The energy savings associated with the recycling of waste plastics using the new separation technology are expected to reach 13.8 trillion Btu annually by the year 2010.

Dew-Point Hygrometer

Drying operations represent approximately 5 percent of the total energy requirements for the U.S. industrial sector, and the heat supplied to industrial dryers is lost mainly through dryer exhaust gas. If optimum conditions are maintained with the exhaust gas systems, and sensors and control systems are used to accurately and continuously monitor the humidity and temperature of the exhaust gas, dryer energy consumption can be minimized. However, existing sensors are often unsuitable for continuous use in many common industrial drying processes due to the high temperatures and contamination encountered in industrial processes. One sensor that is capable of withstanding these types of conditions is the heat flux dew-point hygrometer, developed by Trans-Met Engineering with funding from DOE. This hygrometer is insensitive to dust and grease and can operate in temperatures up to 500°F and in relative humidities between 50 and 100 percent.

A prototype unit of the new sensor was successfully tested at a textile mill. The hygrometer was subsequently commercialized and is being used in the food processing, pulp and paper, chemical, and cement industries, in addition to the textile industry. Estimated energy savings associated with this sensor are 105 trillion Btu in the year 2010.

Optical Humidity Sensor

The pulp and paper industry has long recognized the value of accurate humidity measurements during drying operations, to optimize process control and minimize energy consumption. Although many types of humidity sensors have been developed, they have experienced reliability problems during operation in mill atmospheres. With DOE support, Spectral Sciences and Pacer Systems have developed a new hygrometer that determines humidity by measuring the absorption of ultraviolet (UV) light. Because the absorption of UV light is a property of the water vapor in the medium (air or process gas), the optical elements of the sensor can be kept from direct contact with the medium, protecting the sensor from contamination. The primary applications of humidity measurement in the pulp and paper industry are in controlling the drying of paper and paperboard. The new hygrometer can be used as a feedback device in the control of a dryer loop, helping to maximize drying efficiency by optimizing the balance of exhausted air and makeup air. Achieving this balance results in energy savings and improved product quality. After successful field testing, the hygrometer was commercialized and has been installed in several pulp and paper mills. The sensor also has applications in the textile, food, and other industries. Energy savings in 2010 are projected to be 17.3 trillion Btu.

Numerical Simulation of Automobile Engine Processes - KIVA II

With the transportation sector consuming about 20 quads of liquid fuels each year, there is a tremendous incentive to develop more efficient advanced engine concepts. Engine efficiency largely depends upon the fuel spray activity in the combustion chamber of the engine and on the ability of the engine to consume the fuel-air charge completely. Hence, it is of increasing interest to designers and manufacturers of internal combustion engines to have the capability to represent an evaporating fuel spray by numerical calculations of chemically reactive fluid flows.

KIVA-II is the latest of a series of multidimensional computer codes that allow numerical simulation of internal combustion engine processes. Developed at Los Alamos National Laboratory with funding provided by the U.S. Department of Energy's Energy Conversion and Utilization Technologies (ECUT) Program, KIVA-II solves unsteady equations of motion in a turbulent mixture of gases that react chemically, coupled to the equations for a vaporizing fuel spray. The user provides the engine specification (e.g., bore, stroke, the compression ratio, piston top geometry/configuration, etc.), a specific starting time (e.g., from the time the intake valve closes), and an elapsed time (e.g., from the time the flame completely consumes the mixture of fuel and air). KIVA-II solves the equations for a finite number of very small computational cells that represent the space where combustion takes place, i.e., between the fixed engine cylinder and the top of the moving piston. The user can also combine the results of the KIVA-II computations with a computer graphics package to visualize the combustion process. For example, different colors may be used to differentiate ranges of temperatures that are computed for the various cells. By plotting the colors for each cell in three-dimensional space, the user can see how the fuel/air mixture is initially ignited and how the flame grows from the initial ignition point and spreads throughout the combustion chamber.

KIVA-II has been accepted as the industry standard for development of automotive engine models, and the program is being used extensively by automotive industry researchers worldwide to help develop energy-efficient, EPA-compliant engines. General Motors has used KIVA-II in the development of such engines as the direct-injection stratified-charge (DISC) and fast-burn homogeneous-charge engines. Cummins Engine Co. uses the KIVA-II code to help engineers examine fuel spray-airflow interactions in their diesel engines. In addition, KIVA-II can easily be adapted to a variety of other applications by modifying the general structure of its program. Such applications include continuous spray combustors, Bunsen burner flames, and non-reacting sprays. Copies of KIVA-II are available to the public through the National Energy Software Center (NESC).

Spark Plug Instrumented with Fiber Optics

Understanding the physical and chemical processes that control combustion is critical to improving the fuel efficiency and environmental acceptability of gasoline and diesel engines. Currently, there are about 130 million vehicles with internal combustion engines on U.S. highways, consuming about 20 quads of fuel annually at efficiencies ranging from 19 to 26 percent. Given this magnitude of fuel consumption, even modest improvements in the efficiency of these engines could yield considerable energy savings. A critical issue in the development of fuel-efficient engines is the characterization of the dynamics of flame growth and the mechanical behavior of fluids. Rough idling, for example, can be due to the influence of cyclic fluid variability on the flame development in the engine combustion chamber. The laser-based measurement techniques currently used to characterize flame growth, such as laser doppler velocimetry (LDV), require the installation of optical windows which may perturb the flow being analyzed and provide inaccurate results.

DOE/ECUT has provided funding for the development of a spark plug, instrumented with fiber optics, for observing flame propagation in the combustion chamber of standard automotive engines. The spark plug may be installed in place of the regular spark plug to make measurements without modifying engine geometry or operating conditions. It has been tested in both a research and a production (Chrysler) engine. Flame development measurements obtained for eight successive engine cycles showed the flame to be more asymmetric than expected of currently engineered designs. Research will continue into understanding the effects of this asymmetry on swirl and turbulence intensity by studying polar velocity plots.

The development of this new spark plug as a fundamental measuring tool has generated considerable enthusiasm in the auto industry. Chrysler Corporation, which has followed its development since the beginning, is scheduled to conduct more extensive demonstrations in the near future. General Motors and the Ford Motor Company have requested complete data and design details. Results of the work were presented at the 1988 SAE International Fuels and Lubricants Meeting.

Whisker-Toughened Ceramic Composites

Ceramics such as alumina (Al_2O_3) have excellent wear resistance and high temperature strength, but are too brittle for wide commercial use. ECUT-sponsored researchers have developed a novel approach to "designed microstructures" in brittle ceramics that provides major gains in fracture resistance.

The technique involves producing a ceramic composite which is reinforced with silicon carbide whiskers, contrary to conventional wisdom that only long-fibers would work. A patent filed by ECUT researchers for silicon-carbide-whisker-alumina composites enabled the successful continued development of this technology by the DOE Office of Transportation Systems, which to date has resulted in nine licensing agreements with the private sector. Based on the results of research conducted with alumina composites, further ECUT-supported efforts have produced a new high strength structural material based on reinforced molybdenum disilicide ($MoSi_2$). This unique composite, fabricated using both vapor-liquid-solid and vapor-solid silicon carbide whiskers, exhibits an increase in room temperature strength (100%) and fracture toughness (30%). The elevated temperature strength of this composite has been shown to increase by 300% over non-reinforced $MoSi_2$.

These unique alloys are already finding a number of applications in the energy technology field. It is projected that the use of whisker-toughened alumina for machine cutting tools, which has already gained widespread industrial acceptance, will dominate that market in the near future. Sales of industry products, including cutting tools, gears, wear parts, and others, is estimated at $25 million for 1995.

Microwave Processing Of Ceramic Materials

The DOE/ECUT Program has funded research to demonstrate the benefits of microwave processing of ceramic materials such as alumina (Al_2O_3) because of its potential to facilitate fabrication of near net-shape components with conventional hot pressed properties. Microwave processing incorporates pressureless sintering at lower temperatures. It has the potential to save energy and reduce process cycle time through uniform, rapid heating of large shapes. The increased throughput possible has the advantage of decreasing operational inventories and increasing manufacturing capacity overall, generally reducing costs. By lowering sintering temperatures and utilizing selective coupling techniques, a whole new range of microstructures could potentially be created.

Sintering and microstructural studies on Al_2O_3 were conducted at 28 GHz, well beyond the normal commercially used frequency. Results showed that at 28 GHz large pieces of high purity alumina can be uniformly heated and sintered. Densification of the material heated in the microwave field was significantly more rapid than that exhibited during conventional infrared processes. The apparent activation energy required for the microwave sintering process has also been shown to be much lower than that required in current processing techniques. Together, these two factors indicate the enormous industrial potential of microwave sintering in terms of greater throughput at lower energy requirements.

Numerous applications for microwave sintering and heat treating exist, including electrical ceramics (varistors, capacitors, IC substrates), wear parts, catalyst materials, and electromagnetic windows. A technology transfer program is being established with the industrial sector, beginning with a technical working group to identify industry needs and problem areas as well as the associated generic technology R&D required.

Rapid Solidification of Metals

The future of many high-efficiency energy systems is dependent on the development of metallic alloys with high-temperature properties beyond those which can be obtained from conventional processes. ECUT-supported research has shown that alloys with superior high-temperature properties can be developed through rapid cooling and gas super-saturation. To achieve rapid solidification (at rates up to a million times faster than solidification of conventional ingots), a gas stream is used to impact and break up a stream of molten metal into fine droplets. The rapid solidification process produces a high concentration of atomic vacancies, which would normally anneal out of the alloy at high temperatures. The dissolved gas entrapped during rapid solidification stabilizes the vacancies in clusters, which then serve as sites for fine precipitates to form and strengthen the alloy. Researchers have seen a 60-fold increase in the service life of austenitic stainless steels processed by this technique. Atomistic calculations have been developed that accurately predict the experimentally measured solubility of inert gas in nickel. These calculations explain the evolution of gas entrapped and produced microvoids, which may enable engineers to better develop new alloys and processing techniques. This novel processing technology will have significant impact on the advancement of more efficient energy systems through stronger, lighter alloys with longer lifetimes.

The concept, which received an R&D 100 Award for 1988, also shows promise for processing iron, aluminum, nickel, and other metal-based alloys.

Thin-Wall Hollow Spheres from Powders

There is great potential for reducing energy loss in homes and in industry through the use of alternative insulating materials that are economical and that demonstrate improved energy-conserving capabilities. Through ECUT-sponsored research, an innovative new process has been developed to fabricate small, hollow spheres (aerospheres) for use as thermally-insulating materials. Aerospheres appear to be the best candidate insulation for very high temperature applications (>1500°C) because of their durability and low cost. At lower temperatures, the advantages of aerospheres are that they are economical to produce, noncarcinogenic, ecologically safe, and non-compressible over time. Their applications as thermal insulators and structural materials are broad and include use as room insulators; high-temperature insulators; fire proof materials; loose, free-flowing building shells; low-density structural fillers; plastic fillers for density control; and uniform-wall, closed-cell foams. The potential also exists to use aerospheres as inert supports (catalysts, molecular sieves) and encapsulants for biological culturing.

The thin-walled hollow spheres are blown by a coaxial nozzle technique using highly volatile powder slurries. These liquid spheres are then dried in an updraft tower and subsequently fired to 1600°C to produce low-density, impervious shells. The thermal conductivity of these shells has been measured to be as low as 0.13 W/m.K, and the production cost may be reduced with novel processing (under development) to approximately $0.50/lb (compared with fiberglass fabrication costs at $0.45/lb).

This innovative processing concept has been used successfully to produce spheres from alumina, partially stabilized zirconia, ferrite, and Kaolin clay powder slurries. In addition to the flexibility of using different materials, this process allows the uniformity, density, and quality of the spheres to be controlled during their production. Spheres of high specific strength and viable thermal conductivity may be produced economically. Modeling studies are underway to characterize the apparent thermal conductivity of beds of thin-walled, hollow ceramic spheres and, thus, to assess their energy-conserving potential. These efforts will provide predictive models for property dependence on gas, gas pressure, temperature, sphere material, and sphere size; and a database will be developed to predict the behavior of new materials used for hollow-sphere processing. Development work has been expanded to include spheres composed of mullite, SiC, Si_3N_4, titanates and metals.

Further development and characterization of these novel spherical insulators will yield alternative materials that are economical to produce and that have outstanding insulating properties. It is expected that these new insulators will have broad industrial and residential application.

Biodegradable Plastics

The use of plastics has become a significant problem for the environment as landfills become overwhelmed and plastic debris pollutes oceans and highways. ECUT-supported research has shown that conventional materials can be used to make plastics that break down in a few years through biochemical mechanisms after exposure to soil and water. The new technology utilizes polystyrene grafted onto starch or cellulose, and may provide the means to recycle items such as garbage bags, styrofoam cups, and milk containers, which presently end up as nondegradable trash.

Emulsifiers are used to allow the polystyrene to attach as a sidechain to the starch or cellulose backbone. The resulting copolymer has as much as 40 to 50 percent cornstarch or cellulose distributed throughout the plastic, in comparison to less than 10 percent in current commercial products. Microorganisms naturally present in the environment feed on the starches, which allows the polymer to biodegrade within a few years. The approach offers some versatility because different types of plastic polymers can be grafted to the starch or cellulose backbone.

It is expected that the manufacturing rights for applications of the new biodegradable materials to fast-food packaging and garbage bags will be sold in the near future.

Bioreactions in Non-Aqueous Media

The efficient use of protein biocatalysts (enzymes) generally requires an aqueous environment, which is a poor medium for most industrial chemical processes. Many viable enzyme catalysts are only slightly soluble in water, creating mass-transfer limitations and low-productivity processes. The end-products of many enzyme-catalyzed reactions polymerize in water, causing a decrease in biocatalyst activity, which results in low product concentrations. Furthermore, these processes often require the use of capital/energy-intensive aqueous separation systems.

The DOE ECUT program is currently supporting research to overcome the critical technical barriers of poor productivity, presence of aqueous medium, and high separation energies, to enhance the potential for use of biocatalysts to produce commodity chemicals. One such effort is the development of new methods for enzymatic oxidative catalysis in organic solvents, for example, for the selective oxidation of aromatic compounds to form hydroxylated products, and the peroxidase-catalyzed depolymerization of lignins. The enzyme polyphenol oxidase has great potential for selective hydroxylation but cannot be used in an aqueous medium because of its low water solubility and the tendency of its products to spontaneously polymerize in water, which consequently causes the catalyst to be modified and deactivated. Research has shown that polyphenol oxidase in a p-cresol/chloroform solvent successfully catalyzes the formulation of hydroxylated quinone at yields of 80 percent. The same reaction in an aqueous medium produces a yield of only 3 percent because of the formation of intractable polymers. The peroxidase-catalyzed depolymerization of synthetic lignin was also accomplished successfully in organic solvents; this has the potential to economically produce useful chemicals of low molecular weight from lignin or lignin waste products.

Two inventions developed from this work already have been licensed for use in the commercial sector: an application for temperature abuse sensors, and a method and apparatus for detecting compounds that utilize enzyme-catalyzed reactions in the gas phase.

A Computerized Tribology Information System

A significant portion of the energy used in various mechanical operations is lost through friction, wear, and poor lubrication of moving parts. Tribology, the study of friction, wear, and lubrication, provides a basis for conserving energy through reduction of energy losses. Tribology research is interdisciplinary and involves lubricant chemistry, surface science and topography, interface contact, elastohydrodynamics, and mechanics. The incorporation of advances in tribology into engineering practice has been slow because of the cross-disciplinary nature of tribology research. In addition, the diversity of data often makes it difficult for engineers and scientists to locate information on advances made in areas in which there are critical tribological limitations. A Computerized Tribology Information System will facilitate validation of experimental results by tribology experts, keep researchers continually updated on new research results, serve as a clearinghouse of tribological news or research breakthroughs, and provide a central location for information on research-in-progress and tribological products. New knowledge in the field of tribology is of interest to those working in transportation systems, electric utility operations, building technologies, and industrial processes.

The DOE ECUT Tribology Program has provided seed funding for the development of A Computerized Tribology Information System (ACTIS) to make available to tribology researchers a broad range of data, design codes, abstracts, and bibliographies of research in progress. ACTIS is designed to allow users to access any database through a main menu or through an interface that connects the databases. For example, a user of the design database may require numeric data for a particular code, which he can then access in the proper format through the appropriate interface. The National Institute of Standards and Technology (NIST) has taken a lead role in directing the development and management of the system. Other participants supporting the project include the U.S. Army, U.S. Air Force, the American Society of Lubrication Engineers, the American Society of Mechanical Engineers, and a number of industries.

The system is now in the commercialization phase and will be available to the tribology community as IBM PC-compatible software. Revenues generated through the use of ACTIS by participating industrial sponsors and proceeds from sales of design codes will be used to support and maintain the ACTIS program.

Pollution-Free Method for Dry Quenching Coke

The processing of coke produces toxic gases that contribute to air pollution and threaten public health when released into the atmosphere. Through a DOE-supported grant, an inventor has successfully tested a totally enclosed system that prevents the release of toxic emissions from coke while it is being removed from the batteries after being cooked at high temperatures. In the new technology, a motorized carrier vehicle is used to transport a large steel container and align it with the coke oven door. The coke is pushed into the container without any pollutants escaping, and is cooled in the same container, without the cooling water touching the coke. Because the steam produced during cooling is not contaminated, the cooling water can be easily recycled. By eliminating both pushing and quenching emissions, the process reduces the need for additional pollution-abatement equipment. In addition, the simplicity of the system offers reduced maintenance costs and easy retrofit into existing coke production facilities. It also produces higher-quality coke from lesser-quality coal and achieves significant energy savings by improving blast furnace efficiency and reducing the amount of coke usually lost as unusable fines generated in handling.

The inventor of the Kress Indirect Dry Cooling Process has contracted with Bethlehem Steel for the first major commercial installation of this new system.

A Movable Air Filtration System

To improve the efficiency of heating and cooling units, many buildings are now built as "closed systems," recycling the interior air and minimizing the introduction of outdoor air into the building. When dust and other particles are trapped indoors, the quality of air in classrooms, factories, homes, and other enclosed spaces is often a major concern for humans and the environment (e.g., wood dust may be present as an air contaminant in shop areas). It may be more energy-efficient to filter the contaminants from the air than to vent the building and use energy to heat or cool the make-up air. With DOE support, a small company (Tech Paper) in Pittsfield, Massachusetts, has developed a special filter paper that contains "microbits," microscopic spheres that attract and hold air contaminants in suspension. The paper is used in conjunction with an ordinary box fan, and operates in a straight-forward manner to filter the room air. The fan is simply placed next to a source of fine-particle contamination with a roll of the filter paper covering one exposed surface of the fan. When the filter paper is dirty, the fan assembly shuts itself off so that a new section of clean paper can be rolled over the exposed surface of the fan.

The Mobile K Filter System is undergoing evaluation in shop classrooms in several school systems where it has proved invaluable in reducing the amount of wood dust to acceptable levels. Thus, it also reduces the requirement of keeping windows open to vent dangerous air, with the implied loss of energy. In addition to energy savings, the air quality in the classrooms is noticeably improved.

Shop classrooms are currently the testbed to demonstrate the effectiveness of the filter paper and its marketability. Other uses for the filter paper are for insertion on-line into machinery in factories where dust and other small-scale debris constitute a health and environmental hazard.

Hydrodynamic/Deflection Pad Bearing

Because bearings are used in the moving parts of machinery, and are therefore part of most industrial operations, improvements in bearing designs are always desirable. Bearings that operate with less friction and wear are needed to improve energy efficiency and reduce processing costs to industry. Bearings that are self-lubricating would be especially desirable because of increasing concern about leak-free seals and contamination of product by bearing lubricants, particularly in the food industry. A grant of $75,000 supplied by DOE's Energy-Related Inventions Program was the seed money required to attract substantial financing from a multinational company for development and further testing of a hydrodynamic/deflection pad bearing. In addition to being self-lubricating, advantages of this bearing include the following: it can operate at temperatures limited only by the materials of construction; it can use low-viscosity lubrications, such as water, as well as standard petroleum-based lubricants; it exhibits long life and reduced maintenance characteristics; and finally, it uses thin-film lubrication to minimize friction and wear.

The bearing, invented by Russell D. Ide of KMC Inc of Coventry, Rhode Island, has been built and tested in over 30 different prototype designs for use in electric motors, outboard motors, polygon motors, drilling equipment, gear boxes, automotive turbochargers, pumps, compressors, and refrigeration equipment. KMC is considered an emerging growth company with international sales and has the potential to become the market leader in the highly competitive international bearing industry. The hydrodynamic and deflection pad bearings are expected to gain market shares in many sectors.

CFC SUBSTITUTES

Mr. **Yates**. Let's turn to CFC substitutes. What is the status of the work that was funded in 1990 in CFC alternatives to be done with an industrial consortium?

Mr. **Davis**. One of the largest pieces of that activity is with the Air Conditioning and Refrigeration Institute through our buildings program that John Millhone runs. I will let him answer that in detail.

Mr. **Millhone**. We have had a number of meetings with ARI and its research institute. They have submitted a proposal for collaborative work that we find is very significant and that we want to pursue with them, particularly in the materials compatibility and lubricants area. One of the questions is whether there is substantial work with the lubricants and materials available.

We don't have a contract in place with that organization yet. We have found a number of procurement requirements that have needed to be completed before the contract could be in place.

We have reached agreement on the work that would be done, and I think that the actual contract will be completed within the next several weeks but it has not been put in place as yet.

Mr. **Yates**. Do you have enough money in your budget to advance the state of that?

Mr. **Millhone**. As you will see in the budget request, there is an increase in funding requested for——

Mr. **Yates**. I know that. The question is whether or not it is an adequate increase.

Mr. **Millhone**. I think we can do the highest priority work with the funds that have been requested.

Mr. **Yates**. What about the lowest priority?

Mr. **Millhone**. We won't be able to do the lowest priority work with the funds requested.

Mr. **Yates**. Is the lowest priority a priority work?

Mr. **Davis**. Mr. Chairman, that is exactly the dilemma we face, not just in buildings but industry and transportation.

Mr. **Yates**. You have written a good story about what you have done in the 1980's, and you are now moving into a field that is extremely important and that is trying to cut down on the use of CFC's.

Mr. **Davis**. Yes, sir.

Mr. **Yates**. It is pleasing to all of us that industry is cooperating with you instead of resisting you as violently as it could. I would hope that we would cooperate with industry in this as well.

Do you have enough money in your increase to take care of the highest priority items?

Mr. **Davis**. Yes, sir.

Mr. **Yates**. Well, shouldn't we be doing more? Will the use of more money for your lowest priority items permit you to make a proportionate advance or to speed up the process?

Mr. **Davis**. I would like to break it into two pieces to respond. One aspect of CFC's is replacement fluids, fluids to replace fluids currently in use whether they are in residential, transportation or industrial applications.

Another topic is the replacement of gases that are used as blowing agents to produce insulation, which primarily is used in the building sector. So there are two key pieces as far as we can see, one in blowing agents and the other is refrigerant working fluids.

On the topic of refrigerant fluids, I would reflect back to some of my industrial experience. We in the industry paid dearly for those CFC fluids. We know what is happening in terms of their limitation and eventual phase out.

We are currently paying a substantial premium to the industry that manufactures them to find replacements. There is a substantial amount of money. I cannot put the exact figure on it, but industry is in fact funding the suppliers of these chemicals to find alternatives.

On the blowing agent side, that gets back to the building sector. There is probably less ability to fund research on that topic in the private sector. We have tried to look at both those aspects and lined up our activities in support of industry's request.

We think we have the right amount of money in our 1991 budget request. We don't think, for instance, we are delaying anybody's activity. Nobody has brought to me an awareness that our request is hampering what industry perceives is the need.

Mr. YATES. What is the answer to my question? Do you need more money?

Mr. DAVIS. Sir, I will stick by our 1991 request for these topics.

Mr. YATES. I know you will but do you need more money? It is a very important field, is it not?

Mr. DAVIS. Yes, it is.

Mr. YATES. Are you going to have to drag industry forward on this or is industry trying to drag you forward? Are you lagging behind? Would the provision of more money for this subject help you and help the cause?

Mr. MILLHONE. In my view we are working pretty closely with industry, and we are both going all out.

Mr. YATES. I get the impression that while you are funding your highest priority items, the lower priorities will be not funded.

Mr. MILLHONE. The funding was $2.5 million in 1990 for this area. The request for next year is $3.2 million in the refrigerant area. I have met with people from ARI and the research group there. There is not very much disagreement about the level of funding. There are some suggestions that they have made for changes within the amount of funding that has been requested.

Those are issues that I think we need to look at. But the general level of funding is about the same as ARI has indicated it feels needs to be spent. We are also working with AHAM, Association of Home Appliance Manufacturers. They have a government-industry research consortium.

Mr. YATES. I just bought a new refrigerator. Should I have waited?

Mr. MILLHONE. The American refrigerators operate in almost all instances where the CFC does not have to be replaced.

TRANSPORTATION CONSERVATION

Mr. YATES. Now let's turn to transportation conservation. How are we doing there?

The impression I have from your two witnesses so far is that we are making substantial progress. Could we have gone faster if we had put more money up in the last five or six years?

Mr. DAVIS. I think the answer is that we could. I would like to make a statement that also relates to our thinking for the organization. We felt that it was necessary not just to look at the efficiency side of transportation—which is certainly important—engines that are more efficient and that operate at higher temperatures—but we also wanted to bring in the other side of the equation, fuels.

We think the transportation sector has to look at deemed reduction or efficiency opportunities, alternative and new fuels, and also at the infrastructure; a full transportation program. What we are now shaping would look at all three aspects.

In the past we have looked at efficiency improvements without a real, strong effort at reducing emissions. Now we are looking at improved efficiency with improved emissions, and the advantage that some of the alternative fuels would offer in the engines, and things that the government needs to support in terms of the overall infrastructure as to how we think about transportation.

We have organized that under one individual, Al Chesnes, raising the office up to a deputy assistant secretary. What used to be office directors are now deputy assistant secretaries of buildings, industry and transportation.

Mr. YATES. Do you have enough money in this budget for your purposes?

Mr. CHESNES. I think we do. I think we have——

Mr. YATES. Could you use more?

Mr. CHESNES. I don't know. In specific areas there may be places where we will find we need more. I think we are going through an integration period right now in trying to tie together some of the fuels work and some of the engine work, and we may find places there where we have additional resources we can use in other places. Some areas are certainly adequate.

The committee and the Administration have been very good to us. In our ceramics program, the Administration has asked for what we need, and the committee has appropriated the funds, and I think that is going very, very well.

CERAMIC TECHNOLOGIES

Mr. YATES. Have we reached the stage that we could move faster?

Mr. CHESNES. I don't know whether we could move faster. We have been putting in as much money as I think industry could assimilate.

You are going to hear industry come in to tell you, and we have to look at that ourselves from the Administration standpoint, that we have not looked at the manufacturing aspects of these technologies as much as we could; we have always left that up to industry. Industry has now said, and I think you will hear them saying it, that the place where the government stops after doing the research and where industry picks up the technology, is a gray area particularly in ceramics, which is new, and it may be an area in which they need help.

We are not talking about a lot of money. We are assessing now and talking to industry to see if there are specific areas where they need help. We think the technology is ready now, and I think we have proven that the technology will work. We can make parts that will live where people said you couldn't do it, at the right temperatures. The question is, do we make them cheap enough and in enough quantities.

The Japanese say they can do it. We don't know whether it is true or not.

Mr. YATES. Are those parts in their cars?

Mr. CHESNES. Our contractors who are looking at a much higher technology level are using the technologies to make parts for cars now. The trouble is, they are not included in most of the production lines because, although our people can make 10, 20, or 30 parts, in order to make 15 million like you need for the car industry, you have to make a big investment in production facilities, and the United States industry is just not willing to make those kinds of investments until they are absolutely sure.

Every one of the component manufacturers—and I brought "touchies and feelies" as examples, like these—valves, and other components; every one of our manufacturers are now making parts like that, that are being evaluated for production. We have a collection of samples from Norton, for instance, a company just bought by the French. All these little parts are now being sold to people and all of them came out of our technology. Here is a little chart that tells you what each part does. They sell them to industry.

Mr. YATES. Are these all ceramic?

Mr. CHESNES. Yes, they are all ceramic.

Mr. YATES. Isn't that something?

Mr. CHESNES. You see the little bearing there——

Mr. YATES. Who bought this company? You say the French bought it.

Mr. CHESNES. It is a French company, St. Gobain. Previously, a British company was trying to take Norton over and they fought it very hard. The British company was a conglomerate and Norton didn't like that.

It turns out the British company did not have a subsidiary company that did ceramics. The French company does ceramics, so technology transfer is easier if the French company buys them.

Mr. YATES. Do American companies make ceramic parts as nicely as Norton?

Mr. CHESNES. GTE does, Carborundum does. Carborundum is owned by the British. These are parts from GTE. That is a valve for current engines. These are little bearing parts from GTE.

Mr. YATES. The bearings aren't ceramic, are they?

Mr. CHESNES. Yes, they are silicon nitride. These are the bearing assemblies themselves right here. They are silicon nitride. Roller bearings, little valve seats, they are all made by GTE.

Here is a turbocharger that GTE makes for Volkswagen. That is all ceramic, including the shaft.

Now, the problem you have when you manufacture those parts not only is making a complex shape, but ceramics are also require machine finishing. The thing that makes them so valuable in the automotive engine is that they are hard so they last longer, give you less friction.

The problem is, the only way you can machine them is a diamond grinding, so you want to make them as close to net shape as possible so you don't have to machine them, because the machining is very expensive. There are a lot of tricks to do that. Theoretically, the Japanese do a better job than we do because those tricks are expensive. The way you learn how to do that is with computer-controlled processing throughout, automated, and they are willing to put the money into those kinds of plants to learn how to do it.

INDUSTRIAL COOPERATION IN TRANSPORTATION TECHNOLOGIES

Mr. **Yates**. Why don't we do it?

Mr. **Chesnes**. I think in general United States manufacturing companies are more near-term profit-oriented than foreign companies are. They are willing to take a longer look.

They also are more willing to cooperate in Japan and Europe. The companies are willing to cooperate a little more in R&D. We have found that that is starting to happen in the United States.

As a matter of fact, in our programs for the first time our ceramic manufacturers and engine manufacturers are cooperating and sharing data and technology development. That was never done before. They are starting to do that in the United States, and I think it is a wave of the future. They are going to have to do that to compete with the Europeans and the Japanese. We are making a lot of progress.

Mr. **Yates**. Shouldn't we be doing other things? Should we be putting money into things like the Japanese are doing?

Mr. **Chesnes**. I think that probably——

Mr. **Yates**. And which we are not doing?

Mr. **Chesnes**. It was hard to do before because the companies would not cooperate. Mike and I went out to talk with General Motors three weeks ago. It was just a visit to the technical center, and for the first time we heard industry saying, "It's about time that industry got together and came in with a cooperative program."

Mr. **Yates**. Let me ask you, GTE is a big company.

Mr. **Chesnes**. So is Norton.

Mr. **Yates**. I know. Norton is gone. Isn't it?

Mr. **Chesnes**. They are only gone if they actually take the work away. If the work and manufacturing is done here and the people are all here——

Mr. **Yates**. That can always happen, can't it?

Mr. **Davis**. Yes, it could.

Mr. **Yates**. But GTE is an American company.

Mr. **Chesnes**. Yes.

Mr. **Yates**. Why doesn't the Department of Energy have a program for inducing companies like GTE to do the same kind of initiative the Japanese are doing?

Mr. **Chesnes**. We are doing a little of that.

Mr. YATES. Why don't we do more? How much money do you need for it?

Mr. CHESNES. It is not clear how you would do it. I think we need industry to come in and say, "This is what we ought to do and this is the way we ought to do it." We went out to industry two or three years ago with a program called CAMDEC and tried to see if we could get industry to cooperate. We would put the money up for some basic technology, and it was really in the manufacturing area, looking at ceramics automated manufacturing technology. We tried to get them together and we could not get them together.

Mr. YATES. Why don't you try it again?

Mr. CHESNES. We probably will.

Mr. YATES. Do you need any money for it?

Mr. CHESNES. We don't need money to see if we can get their interest. We may need money if it works.

Mr. YATES. Don't you usually catch their interest if you have some money to offer?

Mr. DAVIS. I think actually we do. I would assert that by organizing ourselves to be more consistent with how the market actually consumes things and looking at both supply and demand, focusing our efforts, we are now in a position to reach out to industry, and we know we need to do that.

We don't have answers to a lot of your questions, but as far as our approach, which is to build a relationship with our business sector much more aggressively than what DOE has done in the past, we are going to get some of those answers. I think that when we have a little bit more time to work that—we are working it now, and we sense that there is more of a willingness on the part of industry to participate—we will have more success. But we have to be more aggressive in reaching out, talking to these people and assuring them that if they come and work on these programs, they can still retain the kind of market advantage that they will have if they did the work themselves.

PARTICIPATION OF NATIONAL LABORATORIES

Mr. YATES. Could any of this work be done in a national laboratory?

Mr. DAVIS. There is a substantial part of work now that is going on in the national laboratories, if you look across the various programs. There is $50 million of work from the total energy efficiency and renewable budget that is done at Oak Ridge National Laboratory, $50 million that passes through Oak Ridge.

Mr. YATES. Why not at Argonne?

Mr. DAVIS. I don't know the exact numbers for all the national laboratories, but there is a substantial number that flows through the national labs. I was at Oak Ridge last week, so they are participating.

Mr. YATES. I know. I am familiar with Oak Ridge, Fermi and Argonne. Aren't they as capable as Oak Ridge?

Mr. DAVIS. I should have had that number on top of my head as opposed to——

Mr. CHESNES. Argonne has specific expertise in the ceramics area. They are probably the experts in the world on the nondestructive evaluation technique.

Mr. YATES. Hardening the ceramics?

Mr. CHESNES. No, looking at it with X-rays. The trick is, before you expend additional processing efforts, to be sure it is good so you have to have a nondestructive evaluation in the process, and they are the experts in that.

ADEQUACY OF DOE BUDGET

Mr. YATES. What do you want this Committee to do, Mr. Davis, just relax and say, "Go ahead, you've got enough money in the budget to take care of our needs"? We really don't, do we?

The Japanese are moving forward; we aren't. The Europeans are moving forward; we are not.

Why don't we speed it up?

Mr. DAVIS. I think it is fair to say that the Committee has always set the standard and that DOE——

Mr. YATES. We try to set the standards. Give us what you need in order to place our country in a competitive position with the others. As a matter of fact, not only in a competitive position, but ahead. Can you do that? Are you in a position to do that?

I think it is equally important to do this as it is in the field of nuclear weaponry at the moment, isn't it?

Mr. DAVIS. We again believe that by looking at both energy efficiency and renewables by sector; by buildings, by transportation, by industry, by utilities; and then beyond that, looking at those sectors by time frame; by near term, mid term and long term; there is more work to be done than we need to do than just by long term. So by looking at it that way and by supply and demand, we believe that we can bring to you substantially better support for these programs from our side of the table.

Mr. YATES. Near term, mid term and long term. Let me give you three choices and ask you what you could do with them.

Suppose you had $5 million more or suppose you had $10 million more or suppose you had $15 more in the field of ceramics; would you be able to move our position faster?

Mr. DAVIS. To the extent that we know the American industrial players that will participate, the answer is yes.

Mr. YATES. Well, then, which figures do you want us to put in? Why don't you put it in the record with some back-up.

Mr. DAVIS. Yes, sir.

Mr. YATES. It is an important field, isn't it?

Mr. DAVIS. Yes, but I would also submit that there is more work DOE has to do before it can answer. I would like to have the industry that has come forward in a number of focused areas also look at the $5 million we are already spending. I think that is appropriate.

Mr. YATES. Put it into the record. We want to help you.

[The information follows:]

FUNDING ENHANCEMENTS FOR CERAMIC TECHNOLOGIES

The FY 1991 budget for Conservation research and development is substantial and well balanced, and supports the highest priority ceramic technology program activities. While additional funding in FY 1991 could be applied to ceramic technologies, it must be pointed out that the projects this funding would support are of lower priority.

Present plans are to propose the initiation of two new projects within the Advanced Materials Development Program beginning in FY 1992. Those projects are "Cost-Effective Ceramics for Heat Engines" (CECHE) with a planned first year budget of $3.0 million, and "Material Solutions for Alternatively-Fueled Engines" (MSAFE) with a planned first year budget of $2.0 million. These projects could be initiated one year earlier with an additional $5.0 million for Advanced Materials in FY 1991. Both projects are designed to accelerate commercialization of ceramic engine components by the U.S. industry and to solve immediate materials problems faced by the U.S. engine industry in implementing alternative fuels in engines. Benefits of ceramic components in engines include substantial reductions in petroleum imports and related contributions to meeting vehicle atmoshperic pollution requirements.

The CECHE Project has the objective of low cost, reliable ceramics for near-term applications (within five years) in contemporary gasoline and diesel engines. The CECHE Project will focus on ceramic machining and finishing, ceramic raw materials, alternative processes, yield improvements, testing and performance standards, data base development and technology transfer.

The MSAFE Project has the objective of cost-effective, reliable materials for use in alternatively-fueled (alcohol, natural gas) engines. The MSAFE Project will focus on compatibility and reliability, and cost effectiveness of ceramic, metal, and polymeric materials. Emphasis will include fuel systems (storage, corrosion, compatibility, structural concerns, and wear and friction), engine components (ignition devices, valve train materials, higher pressures and temperatures, friction and wear), and exhaust systems (emissions, catalysts, supports, and filters).

At a $10.0 million enhanced budget level in FY 1991, work could be expanded to include several cooperative programs on developing low-cost approaches to ceramic grinding and finishing, the single largest contributor to high cost in structural ceramics. Reliable ceramics are being developed and demonstrated in the Ceramic Technology Project, but high cost is a barrier to commercial applications. In addition to the high cost, grinding and other surface finishing processes can introduce flaws that reduce mechanical reliability. The low-cost approaches must be shown to introduce no penalty in reliability. In addition, tougher ceramic microstructures, which will make the ceramics more tolerant to surface damage, could be developed.

Work could also be expanded to begin immediately compatibility and corrosion testing of fuel system component materials for alcohol fueled vehicles. Tribological testing of diesel fuel pump and fuel injector systems could also be initiated. The earlier implementation could be important to the engine industry in responding to alternative fuels and clean air legislation and would contribute to development of cost-effective engineering solutions, which would have a favorable impact on vehicle cost.

At a $15.0 million enhanced budget level in FY 1991, elements of ceramic manufacturing technology in the program could be enhanced and accelerated. Sensor development for real-time, on-line monitoring and control of process variables could be started and development of computer process models needed for automated, intelligent processing could be initiated. Ceramic manufacturing technology issues (statistical process control, automation, real-time sensors, robotics, intelligent systems) are crucial to reliability, cost effectiveness, and U.S. competitiveness. It is in these areas of ceramic manufacturing technology that the United States has fallen badly behind the Japanese.

ALTERNATIVE FUELS

Mr. YATES. Let's talk about alternative fuels for a minute. I keep reading that the oil companies ought to be changing their fuels—we need the other kinds of fuels, but really getting rid of some of the aromatics that they use.

Do you do anything on that?

Mr. DAVIS. Yes, sir.

Mr. YATES. How do you persuade them to use fuels other than the so-called octane-producing aromatics which I understand are contributing in a major way toward pollution of the air.

Mr. DAVIS. The aromatics—benzene, xylene, toluene—are major contributors to urban smog. They also are being used as a way of producing the octane.

There are alternatives to those additives. The alternatives that we address flow out of, if you will, ethanol and methanol directly, as ethanol and methanol mixed with gasoline or as ethanol and methanol converted to ethers. As ethers, they are more readily usable mixing directly with gasoline and pushing through the pipeline.

So the activity of the oil industry toward reformulated gasoline is one that we support. That includes more alcohol fuels. We think that is a step in the right direction and it is an introductory step.

Mr. YATES. Are they doing it?

Mr. DAVIS. Yes, they are. I think there are a couple of market areas. For instance, the addition of alcohol is being used to meet requirement of oxygen content in fuels at high altitudes during the winter driving season. So there are moves in a number of areas to encourage the oil industry to provide better, cleaner fuels. That may well be a part of the clean air amendments.

Certainly California is taking a number of steps on its own to move in the direction of requiring cleaner fuels.

Mr. YATES. California is taking a major step. It will be interesting to see what the initiative does when the people vote on it.

What about the question of the fuel pumps and the prevention of the escape into the atmosphere of the benzene and the other pollutants? Are you doing anything about that?

Mr. DAVIS. Sir, I don't believe we have any activity in our program to actually address the evaporation of fuels in the fueling process.

Mr. YATES. Do you have any opinion as to whether the new pumps ought to be used?

Mr. DAVIS. There are numbers that suggest that a fair portion of the emissions are in fact produced at the refueling or through the refueling process.

ELECTRIC VEHICLES

Mr. YATES. Well, how close are we to a battery for an electric vehicle? GM says it has one.

Mr. DAVIS. I think we are within about 200 miles.

Mr. YATES. You mean the range?

Mr. DAVIS. I think the range is roughly 100 miles, and we think it needs to be more like 300 miles.

Mr. YATES. On February 8, 1980, the Washington Star had a headline, "GM Shows Serious Intent to Produce Electric Car." It is very good on PR work, isn't it, for the company? 1980—are they any closer? I guess they are closer to an electric car, but how much closer? It is the battery that's been the issue in 1980 to 1990, isn't it?

Mr. DAVIS. I believe it is still the battery that is the largest issue. Progress has been made in the aerodynamics and weight and control, if you will, but both the weight and the lifetime of the battery and the replacement cost of the battery are substantial issues.

Mr. YATES. Are we at dead center on that? Are we making any move on it—not "we," but the companies that you have hired to find the answer?

Mr. DAVIS. It appears at least that GM is far more willing to participate with us on the battery problem. As we stated earlier, we made an effort to focus our battery work in the fiscal year 1991 request. We talked about that at a recent hearing. We have focused on three battery pairs, and in addition to those pairs, there is the current concern about what can be done with a lead acid battery because that is the battery they are using in the Impact.

So the three pairs we are talking about plus what can be accomplished with a lead acid battery are all legitimate questions.

Mr. YATES. Any progress being made on the kind of battery that is needed for the car in any other country?

Mr. DAVIS. I don't know if there are any countries that are ahead of us in terms of battery technology.

Mr. CHESNES. I don't know of any. The Japanese have just had an article in the paper talking about a new battery, but it really isn't a battery; it is a capacitor. They are having the same problems we are.

Mr. YATES. Isuzu Motors announces it has succeeded in trial manufacture of a new electric-power storage source, with super capacity, filed jointly with Fuji. The new power storage source stores electricity for recovery of solar energy and wind power as well. If combined with a solar battery, it may accelerate development of an electric vehicle.

Are we doing that kind of research? I think I read somewhere years ago that in Israel, they had a car with solar batteries on the top.

Mr. CHESNES. There were several. As a matter of fact, GM had a car. They are sponsoring a program in high schools and in colleges for actually running cars that are driven by solar energy. I think the United States is probably as far along in that technology as any country.

Mr. YATES. How far can you run a car?

Mr. CHESNES. What you are looking at is that people are thinking about the solar part being a trickle charge for the battery. You have a battery-driven car with solar power charging, and you expand the range. The problem is range, and anything you could do to expand the range is going to be helpful.

We are working on that, and we have people in our other side of the house looking at the solar technology, which is an important part of it.

FUEL CELLS

Mr. **Yates**. What about fuel cells for powering a car?

Mr. **Chesnes**. We have two programs ongoing now. One is the bus program. In the PEM fuel cell area, we have an RFP, which I believe is finished now and they are evaluating proposals. It will be another 30 days or so before we will have a contract for the first phase of a PEM program. It just turns out that all the programs we have been working on over the years, electric vehicles, gas turbine, fuel cell, although we looked at them for energy reasons, they probably are the primary options now that are available for improving the environment; and fuel cells, electric vehicles, high-efficiency engines like the gas turbine are probably, if you are really going to solve the environment problem, are what you are going to have to do.

As you said, California is very interested because of their environmental thinking so they are putting some of their money in our program areas. They are also working with us on the alternative fuels program.

Mr. **Yates**. Do we have enough money in the budget to advance the state of the art of fuel cells for this purpose and the other technologies?

Mr. **Chesnes**. The fuel cell program is an area which is involved in the reorganization now. Part of the fuel cell work was done in the renewable area, and we are still trying to put that together.

We believe there are enough funds if you consider both of the programs. We still have to look at that very carefully for next year.

Part of the funding is coming from the other side and we are still working on that.

Mr. **Davis**. For the PEM fuel cell, we have just over $5 million in the Energy and Water 1991 request, and I believe that if you look at the battery program which we have in the transportation sector—and our intention is to also look at fuel cells as a transportation application—that there is legitimate opportunity in both those two tracks. Fuel cells may eventually be easier to progress on than batteries, so we are going to push on both of them.

When you aggregate the funds we have on the PEM fuel cell, we think we have an adequate request to make good progress there.

AUTOMOTIVE GAS TURBINE

Mr. **Yates**. You are suggesting the turbine engine ought to be reduced to one contractor. Are you serious about that? Do you think that that is a constructive suggestion? Shouldn't you continue researching this with more than one contractor?

Mr. **Davis**. I think it is legitimate to continue with more than one contractor.

Mr. **Yates**. But this is the result of budget restrictions?

Mr. **Davis**. Yes, sir, but there is another issue, the whole question of cost sharing. It may be a little bit late in the game on the turbine activity because that apparently will be complete with the use of 1992 funds. But our view is if you look at the work that is actually being done, it is important work that is being well done and they are two strong teams.

If you compare that work to the work being done on high-temperature superconducting materials, which is risky work, the level of cost share is 50/50. The level of cost sharing in the advanced gas turbine work is running up to 20 percent, so one could easily surmise that if we had a competition, we would either have the strongest competitor of the two, or we would have both if they were willing to increase the cost share. That was some of my initial thinking.

I also have to reflect as we have talked to the particular contractors in more detail, whether their level of cost sharing goes beyond the 20 percent that actually shows up in the government contract. There is no question that the facilities and expertise that they bring to these contracts on their side are also an important consideration, and I personally don't know that I gave that adequate weight in the decision.

PEM FUEL CELL

Mr. YATES. Is there any advantage to the PEM fuel cell?

Mr. DAVIS. There are a couple of advantages. It is smaller, and it operates at roughly room temperature. I guess a third advantage is that the feedstock for the PEM fuel cell is much less problematic; methanol as opposed to some of the other more difficult chemicals involved in the other fuel cells.

Mr. YATES. Is this something that the Connecticut firm is working on, United Technology?

Mr. DAVIS. No.

Mr. YATES. They are for the big fuel cells. Who does this work?

Mr. CHESNES. It is an RFP.

HEAVY DIESEL TECHNOLOGY

Mr. YATES. How about your heavy diesel? What is the status of that technology?

Mr. DAVIS. I think we have had incremental improvements in terms of efficiency. I think the emissions question and environmental impact question is still a tough issue, and I think alternative fuels for diesels is still a tough issue. I will ask Mr. Chesnes to comment.

Mr. CHESNES. I think we are making a lot of progress because it turns out the technology we are working on has more and more application because of the environmental problems.

When we looked at the adiabatic diesel, we had to solve high-pressure problems for injectors, and it turns out that is the problem they are having with alternative fuels. We had to solve materials problems, and they are being used already by industry, so in the adiabatic diesel program, there is a lot of technology being used incrementally. It looks like the complete engine is still talked about two years away and they are right on schedule.

There are three companies working on it: Cummins, Detroit Diesel, and Caterpiller are all working on it.

Mr. YATES. What happened to the Japanese-American, a young man saying he had a new revolutionary diesel?

Mr. CHESNES. He left Cummins and started his own little company, and he didn't realize how difficult it was to run your own company. He is still a brilliant young fellow.

MAGNETIC LEVITATION

Mr. YATES. What about magnetically levitated transportation systems? Is it the French that are going to build a railroad with magnetically levitated——

Mr. CHESNES. No, the French have a high-speed rail system which is a rail system, at this time not levitated. The Japanese and Germans both have levitated systems, and they are both marketing very heavily in the United States.

Mr. YATES. Are they in operation now?

Mr. CHESNES. Nobody has a commercial one, but both have test tracks. Germany has one 20 miles long and Japan has one maybe 10 miles long. They have real proposals in the United States to do one in Las Vegas, and one in the Pittsburgh area. They have a proposal in Florida. The United States is the big market for that because we have areas large enough to make them reasonable.

Mr. YATES. It takes all the bumps out of the tracks, doesn't it?

Mr. CHESNES. There are no bumps in the tracks. Better not be. But those technologies are available. The maglev program that we are looking at in the United States is going to take a look at where those two technologies are and see if it is practical or intelligent for the United States to come up with a leap-frog technology rather than letting Japan and Germany take all the business.

WASTE ENERGY REDUCTION

Mr. YATES. Do you deal with waste energy reduction?

Mr. DAVIS. Yes, sir, we do.

WASTE CONVERSION

Mr. YATES. What is the scope of your work in biodegradable plastics?

Mr. DAVIS. We have some work under way. We have looked at converting biomass waste, specifically potato waste and cheese waste, to plastic products. That is the one specific project area that I am aware of.

Mr. YATES. Does it have anything to do with conversion of garbage?

Mr. DAVIS. Yes. We are also looking at the conversion, of municipal waste to energy, as well as ways to convert it into liquid fuels.

Our primary focus right now is looking at combustion products associated with municipal waste, what goes up the stack and what is left over in the ash. Currently we recycle 10 percent, burn about 10 percent and bury about 80 percent. When we bury it, we lose the resource and create a problem because when we bury it, we put methane back in the atmosphere.

Mr. YATES. There is no room left.

Mr. DAVIS. There is no room in landfills, but it is also making it more difficult to see the actual pollution that results from burying waste. We would like to spend a substantial—we are looking very carefully at the opportunities in municipal solid waste combustion.

Mr. YATES. You made a mistake saying we would like to spend some——

Mr. DAVIS. More time and effort.

Mr. YATES. Is there enough money in the budget?

Mr. DAVIS. We have requested an amount to reprogram in fiscal year 1990 for these topics, and we are going to meet tomorrow and sort out how to proceed on that.

Mr. YATES. Should we make that appropriation in our committee?

Mr. DAVIS. I will leave that to the Committee to decide what the appropriate jurisdiction is.

Mr. YATES. Is this something that should go forward?

Mr. DAVIS. Absolutely.

Mr. YATES. How much money do you think you want for this?

Mr. DAVIS. We have identified what we need to get started in 1990. We have a request in 1991 that we think is appropriate. We think we are on the right track, but we want to start it and it is important to us to be able to start it in fiscal year 1990.

If we are not able to start it in fiscal year 1990, I certainly would include that amount of money in our fiscal year 1991 request.

BUDGET PRIORITIES

Mr. YATES. Just tell us you are going to have a wish list, a budget that you wish you had that you are going to submit to the Committee for the important things that you want to go forward with and not leave until 1992. Things that you will start in 1991.

Mr. DAVIS. Certainly in the industrial area there are a number of major things, but two of them are conversion of waste to either energy or other high-value products, and the second is the minimization of waste throughout the entire process. That may well be the minimization of waste energy throughout the industrial process. It also certainly is the minimization of waste materials.

We have got to move the marker. Now we have the marker at the end of the process, called regulations on emissions where it takes a substantial amount of money to comply. It is hard to find the additional money right now given our competitiveness to reinvest back up in the process, but we have to aim earlier in the process, and design processes to start with that to minimize waste.

We also have to be realistic about conversion of those wastes. We think a lot of technology is in hand to convert the waste, but jurisdictions have problems. If we do burn these things and convert them to electricity, what are we dealing with in terms of emissions and ash disposal? We very much want to answer those questions.

Mr. YATES. Any municipal plants that are doing well?

Mr. DAVIS. They are certainly coming on line. The amount of additional megawatts that we believe are possible from burning municipal waste is a substantial number, and if you look at the amount of electricity we are going to need, particularly along the East Coast—there is probably more need in the Northeast as well as in states like Florida—I think it is important that we look at the municipal waste resource to make sure we take advantage of it.

Mr. YATES. Does operation of those plants result in air pollution?

Mr. DAVIS. It does. That is why I think we need to work with the EPA so we know clearly what is actually being produced.

I would also say that you can operate those plants by, for instance, cofiring with natural gas or coal. One of the important elements of what comes up the stack is controlling combustion temperature, and that allows you to get reasonably complete combustion so you know what the waste emissions are, so that you can control those.

MULTISECTOR TECHNOLOGIES

Mr. YATES. Let's turn to the multisector. How are you going to assure the same flow of new technology and efforts which are in energy conversion utilization will reside in the new organization?

Mr. DAVIS. The ECUT program before looked at five areas, combustion, materials, biocatalysis, tribology, and heat transfer. Four of those programs were transferred to one other location within our organization. Neither the mission nor the scope was reduced. Those went to the Industrial Technologies office. The tribology program went to the Transportation Technologies office. So all the pieces were transferred complete.

The managers of those programs were also transferred and in fact moved to a higher level, if you will, within the organization across the board. Each of those managers is in a new position and we are quite happy with that.

I would like to answer that further, if I may.

Mr. YATES. Sure.

REORGANIZATION OF CONSERVATION OFFICE

Mr. DAVIS. One of our objectives in structuring this organization was to recognize the cross-cutting activities that are necessary in any organization. By building our major organization by sector, we think we are in a better position actually to leverage funding available in the Energy Research portion of DOE's budget. We will be working more closely as an entire organization with Energy Research than we have in the past.

COMBUSTION RESEARCH FACILITY

Mr. YATES. Is that why you have got a combustion research facility included in your budget?

Mr. DAVIS. Sir, part of the activities that are supported in that facility we fund. Energy Research also funds it, and they fund the majority of the activities.

Mr. YATES. We are going to have a whole series of questions that I want you to answer for the record, if you would promptly, together with your suggestions to the Committee as to where it could constructively place additional appropriations to advantage to your programs.

WEATHERIZATION PROGRAM

Mr. YATES. What about the weatherization program? You took a real big hit in that. Shouldn't that program be continued?

Mr. DAVIS. Sir, we think it should be continued and our request reflects two issues.

In the $30 million that we requested, $15 million of that provides for full funding of all the people and system. Another $15 million is aimed at trying to create more incentive in the weatherization program for bringing more private sector funds to the solution, if you will, just as we are trying to accomplish in relighting Federal facilities.

Mr. YATES. But that won't happen in 1991, will it?

Mr. DAVIS. We believe it will happen in 1991.

Mr. YATES. You won't be able to take care of the needs of these people, will you?

Mr. DAVIS. I wouldn't anticipate, no, sir, private funding making the whole difference, but I would say that in our analysis of the money available to the states, that in all 50 states there is a substantial amount of money unexpended from prior year appropriations or from the petroleum violation escrow funds.

Mr. YATES. All right. We have our request to you and you have your request to us. So would you let us have the benefit of your answers to the questions and your other material.

Thank you very much.

Mr. DAVIS. Yes, sir, and thank you.

[Questions and answers for the record follow.]

Additional Committee Questions

Energy Efficiency Initiatives

Question: In late January the Department announced a series of energy efficiency and renewable energy initiatives. The Committee recently has approved a fiscal year 1990 reprogramming request for those initiatives under its jurisdiction.

Please explain why these activities focus on non-research and development activities?

Answer: Fiscal Year 1990 appropriations form the basis for sustaining core research programs in energy efficiency and renewable energy technologies. Building on that base, DOE requested Congressional approval for certain high-priority energy efficiency and renewable energy initiatives.

The initiatives generally involve either applications-oriented research (manufacturing technology for photovoltaics, developing ethanol fuels, solar detoxification of hazardous wastes, energy from municipal waste) or efforts to stimulate market acceptance of research products (relighting Federal facilities, relighting commercial buildings, accelerated building guidelines and standards, integrated resource planning, Energy Analysis and Diagnostic Centers).

These initiatives represent choices and focus -- choices about the most promising opportunities to pursue, and focus on those that will have the highest payoff. They build on existing successful research programs and are responsible to testimony gathered in the National Energy Strategy hearings.

Question: Do you plan to deemphasize longer term research and development in order to concentrate on short-term activities?

Answer. In past years, the Department's focus has been almost exclusively on high-risk, long-term research. Without neglecting long-term research, we determined that a more balanced mixture of near-, mid- and long-term activities would better meet our country's needs.

The following criteria have been used to evaluate our budget and mission:

End Use -- The application of our technologies to industry, buildings, transportation or utilities.

Time Frame -- The availability of our technologies in the near-, mid- or long-term.

Supply/Demand/Infrastructure -- The usefulness of our programs to develop additional energy supplies, to reduce energy demand, or to reduce institutional barriers that constrain the use of our technologies.

We have sought a balanced portfolio of activities among the sectors, among the time frames, and among supply, demand, and infrastructure.

Question: Most of the initiatives use words like "to encourage" and "to promote" and do not fund activity that directly would affect efficiency.

Answer: the government's role generally should not be to install energy efficiency measures directly. That job can only be accomplished effectively through a reliance on market forces. One area of legitimate intervention, however, is in our own facilities, and we have acted accordingly with the initiative on relighting Federal facilities.

Question: What indications do you have that such approaches will be successful in the face of continued low energy prices?

Answer: We believe that energy efficiency measures in most cases represent a cheaper source of energy supply than additional generation. The integrated resource planning initiative, to take one example, would encourage public utility commissions to treat demand-reduction measures on the same basis as construction of new supply. Even at current energy prices, we believe such a comparison will lead to substantially increased energy efficiency.

With regard to our initiatives in renewable energy, our program goals in photovoltaics and ethanol fuels, for example, are aimed at bringing the cost of energy from these sources into a competitive position with conventional alternatives within existing market conditions.

Relighting Federal Facilities

Question: From where will you obtain the "lighting specialists" required to audit Federal utilities?

Answer: The "lighting specialists" will be part of an energy efficiency team assembled by DOE. This team will consist of representatives from DOE, GSA, the national laboratories, and the Potomac Electric Power Company (PEPCO). The team will include lighting designers who have had successful experience in achieving energy savings in similar projects in the past.

Question: How will facilities be chosen?

Answer: GSA will make the final decisions as to which buildings will have retrofit lighting installed. GSA will do this by comparing the economic benefit (payback), including benefits from utility company sponsored demand side management programs, with other proposed GSA energy efficiency projects nationwide. Those projects which compare favorably will be funded directly. Other projects will be completed as shared savings projects.

Question: What kind of cooperation do you anticipate from the private sector in this initiative?

Answer: It is anticipated that utilities and energy service companies will be enthusiastic participants in the lighting initiative since the benefits to both are expected to be significant.

Question: Do you expect the projects to be financed by the private sector?

Answer: We expect that the private sector will finance all or a substantial portion of these projects. In many cases utilities have established commercial lighting incentives/rebate programs which are available to Federal facilities.

Question: How attractive is this option to the private sector?

Answer: This lighting initiative is attractive to utility companies because it offers the opportunity to apply cost effective demand-side energy efficiency measures to Federal facilities in the utility's service territory. For those facilities which will be retrofitted as shared energy savings projects, we expect that energy service companies will be able to make an adequate return on their investment. These facilities in most cases represent a significant load on the utility's total system.

The initiative is also attractive to lighting designers and the manufacturers of energy-efficient lamps, ballasts, fixtures and controls, who see an opportunity to accelerate the marketing of those products to the Federal sector. They also are attracted to the stimulus for other government and private sector investments in lighting efficiency that can flow from Federal leadership in this area.

Question: What magnitude of savings do you expect from this program and in what time?

Answer: Federal agencies currently use over 0.8 Quads of energy per year, with over 25% of the total estimated to be for lighting of facilities (.2 Quad). We estimate that by using new technologies to reduce Federal lighting energy requirements, we would save .05 quad by the end of the project if all agencies participate.

Question: Would the kind of cooperative agreements developed in this program be different from other "shared savings" program?

Answer: Yes.

Question: If so, how?

Answer: These cooperative agreements could be different because they could include the rebates and financial incentives offered by utility company commercial lighting programs. The typical shared savings agreement does not include this option.

Question: In addition to relighting, the 1991 budget assumes installation of other equipment by the private sector and installation of DOE monitoring equipment, as well as facility modifications provided by the Federal agencies. (p. 300-301). How much of your proposed funding is for DOE furnished monitoring assignment?

Answer: Program Technical Assistance activities associated with instrumenting, monitoring, and evaluating the test bed equipment include both the establishment of analytical procedures, as well as, the monitoring equipment. Within the Program Technical Assistance element, $200,000 is budgeted for both development of evaluation procedures and monitoring equipment. Approximately 10% ($20,000) of the $200,000 would be used for monitoring hardware, installation, and data collection for 6 months to establish performance and operations measurement.

Question: What kinds of equipment are expected to be installed by the private sector?

Answer: From discussion with the private sector and potential Federal agency participants, there are several kinds of emerging efficient equipment that are being considered for testing. These include space conditioning technologies (chillers, desiccants, advanced heat pumps), power electronics, and small thermal storage.

Question: How is this coordinated with the relighting program?

Answer: The coordination is conducted through the Federal Energy Management Program and utilization of the Interagency Energy Management Task Force established by the Federal Energy Management Improvement Act of 1988 as well as coordination using the Infrastructure Modernization Implementation Council established by DOE in 1989.

The test bed project under the Program Technical Assistance program is designed to accelerate the commercial introduction of new products, materials and processes which have the potential for significant energy savings. With these new products, Federal agencies will give careful attention to the engineering, environmental effects, reliability and monitored performance of the test bed products. The relighting initiative will focus primarily on the application of known energy-saving technologies and will not require such extensive supporting engineering and monitoring.

Question: What funding is available from other Federal agencies?

Answer: The specific dollar amount of funding will vary depending on the specific test bed project chosen. However, it is expected that there will be cofunding of test bed projects by the participating Federal agency and industry.

Question: Does DOE have general facility funds in its own budget to do this?

Answer: The DOE In House Energy Management (IHEM) Program budget provides funding for retrofit projects in DOE facilities. In FY 1990 and 1991, IHEM will be funding demonstration projects involving new technologies that advance the state-of-the-art in energy conservation and generation. The IHEM budget is not part of Conservation and Renewable Energy. It is under the Energy and Water Appropriation as part of the Office of Administration and Human Resource Management. Specific funding levels for demonstration projects have not been identified at this time.

Question: The budget justification speaks to providing technical assistance to other Federal agencies to implement "prototypical energy projects" to improve energy utilization. (p. 301) How will this assistance be implemented?

Answer: To expedite adoption of advanced prototypical energy projects, DOE envisions a number of implementing activities. These include such activities as facility wide systems analysis of supply and demand options, engineering analysis, preliminary design and costing analysis, development of performance and operations criteria, and program management of demonstration projects.

Question: Have agencies indicated a willingness to undertake such projects?

Answer: To date, DOE, DOD and NASA have indicated an interest in infrastructure modernization options and prototypes including small packaged cogeneration, municipal solid waste to energy projects, fuel cells, thermal storage, and corrosion control technologies. These agencies have indicated a strong interest in adopting these technologies and a willingness to fund a major portion of these projects.

Question: Have they requested funds to do so?

Answer: Federal agencies currently have operations and maintenance budgets for smaller size non-construction infrastructure retrofits. For larger construction projects, agencies would need to incorporate these projects into their construction budgets.

Question: What kind of projects do you have in mind?

Answer: As identified above, there are a variety of projects that may be feasible, including cogeneration, municipal solid waste, fuel cells, thermal storage and corrosion control technologies.

Question: How have "shared savings" contracts worked so far?

Answer: The shared savings contracts, under which construction is complete and energy savings are being generated, have worked very well to date in the view of both the Federal agency and the contractors.

Question: How many are in place?

Answer: There are five Federal shared savings contracts in place as of May 1, 1990.

Question: What problems are there in getting them in place?

Answer: From the Federal perspective, problems exist in convincing agencies to undertake shared savings projects, drafting equitable agreements that are fair to both the Federal government and the private sector, and in coordinating the development and processing of new procurement and financing techniques associated with shared savings contracting.

Question: What additional work are you doing to improve this process?

Answer: The Department, through the Federal Energy Management Program, is working with other agencies to determine a process by which Federal agencies can identify and select contractors for negotiating ~~shared~~ shared savings contracts that are qualified by past experience to undertake the desired energy conservation/efficiency projects. In addition, we have developed, and offer through the General Services Administrative Training Centers, a course to teach agency facility managers and procurement officers about shared energy savings contracting.

Question: What incentives are there for agencies to do this?

Answer: Agencies have an incentive to use shared energy savings contracts for a number of reasons. There is no "up front" capital expense in these contracts for the equipment necessary to make the energy efficiency improvements. The contractor makes this investment and assumes the risk for the performance of the improvements. Agencies do not make any payment to the contractor unless energy savings can be verified.

Agencies are allowed to retain in their operating budgets the funds which would normally be obligated to pay their energy bills without the shared energy savings contract. This allows them to use any unobligated balances for further energy efficiency investments.

Contractors that enter into these contracts usually are required to operating and maintain the improvements during the contract term. This can reduce the staffing requirements of the participating agencies.

Question: Please explain what actions you expect to take to influence relighting of commercial buildings. The initiative evidently involves setting standards for lighting.

Answer: Under the Relighting Commercial Buildings initiative, the Department is undertaking a study of options to increase efficiency in commercial lighting.

In addition to this initiative, the Department's research and development progrm is working on the following projects that deal with efficient commercial lighting:

- light sources, e.g., surface wave fluorescent lights; and
- building applications, e.g., computer-aided lighting design.

Question: The initiatve evidently involves setting standards for lighting.

Answer: The Relighting Commcercial Buildings Initiative is looking at various options for increasing efficiency in commercial lighting, including the efficacy of efficiency standards.

Question: How would this be done?

Answer: The initiative will be performed under the Department's existing authority as set out by the Department of Energy Reorganization Act. The Department is not authorized to propose standards for commercial lighting under current legislation.

Question: Is there any legal basis for doing so?

Answer: As written, section 321(a)(1) of the Act authorizes the Secretary of Energy to add covered products only in the residential sector. Therefore, if commercial lighting products are to be included in the program, it would require an amendment to the Act. At a minimum, sections 321(a) and 322(a) of the Act would require amendment in order to allow for the Department to consider commercial lighting products.

Question: Is there any interest in the private sector in doing this?

Answer: The Department has not received any expressions of interest by manufacturers in the Department's commercial building lighting initiative. However, manufacturers have support some of the options being considered. For example, individual manufacturers are participating in the DOE lighting research program. The Department is not aware of any interest in the private sector for DOE developing either test procedures or standards.

Question: Is there any interest by legislative Committees in Congress?

Answer: The Department has not received from legislative committees in Congress any expressions of interest in the Department's commercial building lighting initiative.

Question: Can test procedures be established even if no "standard" exists?

Answer: Yes. The Department has broad authority under existing legislation that would support the development of voluntary test procedures.

Question: Who would establish these test procedures?

Answer: DOE, in consultation with the National Institute of Standards and Technology (NIST), the lighting equipment manufacturers and their representatives, including the National Electrical Manufacturers Association (NEMA).

Question: Draft program documents show $2.2 million in this general area in 1990 and a request of $2.7 million in 1991. Of what does the funding consist?

Answer: The Energy Policy and Conservation Act requires the Department to develop and maintain the test procedures for 13 types of appliances and to perform at least two standards reviews to determine if new, more stringent standards are justified. The $2.2 million consists of $1.8 million to carry out the Department's ongoing appliance standards responsibilities for the 13 products, and $0.4 million for a new initiative on commercial lighting options. The Department has notified the Congress of its intent to reprogram funds to support this study of options to increase commercial lighting efficiency. Of the $1.8 million, $0.7 million is for test procedures and $1.1 million for standards development. The FY 1991 request for appliance standards is $2.0 million, $0.75 million for test procedures and $1.25 million for standards analysis and rulemaking. The Department has not requested any additional funding in FY 1991 for the new initiative.

Question: In what specific areas is this funding identified in the budget?

Answer: The Department is requesting $2.2 million for the Appliance Standards Program as shown on pages 297 and 298 of the budget request to carry out the current requirements of the Act.

Question: How much is related directly to this initiative in 1991?

Answer: No funds are requested in fiscal year 1991 to support this study. However, the Department has requested funds to increase the efficiency of commercial lighting. For example, the lighting research and development activity is directly related to improving the efficiency of commercial lighting.

Question: What is your expectation as to when energy savings will be realized from this initiative?

Answer: Savings from this initiative should start about five years after the enactment of legislation, should our analysis indicate that legislation is warranted. The actual date is dependent upon the completion of a rulemaking setting mandatory energy conservation standards. The rulemaking would include an Advance Notice of Proposed Rulemaking, Proposed Rule and Final Rule. The analysis and rulemaking are estimated to take three years, and the standard would go into effect two years later in order that manufacturers have the time necessary to make the changes required by the standard.

Question: Without legislatively mandated standards how much use of high efficiency lighting do you expect to achieve?

Answer: The extent of energy savings is dependent on what option is chosen as a result of the study of ways to increase the efficiency of commercial lighting. For example, if test procedures are chosen, commercial building managers will be able to take efficiency into consideration and choose the most cost-effective lighting. Adoption of major architectural innovations like low-E windows has been good, and it is hoped that building managers and owners will adopt more efficient lighting, as long as the product provides a comfortable working environment and is cost-effective.

Accelerated Building Guidelines and Standards

Question: Please explain what training is necessary under the planned building guidelines and standards initiative.

Answer: Designers using the standards for the first time will need assistance in understanding the contents, requirements, and principles of effective energy conserving building design upon which the standards are based. These standards incorporate improvements made over the past dozen years in energy conservation techniques, energy calculation methods, and indoor air quality knowledge. To accelerate the use and acceptance of the standards, it will be important to provide information on both the design principles and design and construction methods which have been demonstrated to perform satisfactorily in accomplishing the purpose of the standards and to improve utilization of energy in new buildings. Code officials will need similar information when they are considering adoption of the standards.

Question: Who would provide the training?

Answer: Training would be provided by the architectural and engineering professional organizations, and trade associations involved in implementing the standards. Other training would be provided by state and 1

Question: Would the training pertain to residential or commercial standards, or both?

Answer: Initially, training would pertain to commercial and multi-family—high-rise standards. In subsequent years training would pertain to single family and multi-family low-rise standards.

Question: What would you do for $60,000 in 1990 and $200,000 in 1991 to encourage state and local governments to incorporate your standards?

Answer: Initially, we would develop examples showing how State and local governments can regionalize or localize the standards. The standards are written as national standards with climate specific criteria as required by the legislation. For example, there are 31 pages of alternative component package tables to present the building envelope criteria for different climatic areas of United States.

The sheer volume the standards may be intimidating. However, the material it can readily be reduced by tailoring the information and criteria to State or local areas. Materials for these State and local areas would be prepared.

Subsequently, we would develop recommended code language that would facilitate adoption of the standards and work with key States in the development of core materials to facilitate the use of the standards by code officials. We would also prepare background materials on the basis for key criteria in the standards. Briefings using these materials would be provided and the training materials and programs would be made available.

Question: Explain why it takes $2,000,000 for a design competition for innovative energy efficient designs in commercial buildings.

Answer: The $2,000,000 budget for the design competition is based on $50,000 to cover design assistance, design evaluation, monitoring of the overall building performance, and the award itself, for each of 40 awards.

Question: Will actual demonstrations result from these designs?

Answer: Yes. The competition would be open only to proposers who submit evidence of intent to construct the buildings.

Question: If so, how much funding, if any, would be provided by the government?

Answer: The government will provide no money for construction. Government funding will be used for instrumentation and monitoring of the buildin

Question: For the five residential demonstration projects also being initiated in 1991 (p. 283) how much will these demonstrations ultimately cost?

Answer: The ultimate cost of the five demonstrations will be $800,000.

Question: How much of the cost of such demonstrations does the government fund?

Answer: The government funds the entire cost of these demonstrations. This includes the analysis of the effect of the standards on builders (especially small builders) and on the cost of constructing such buildings and the impact of such cost on the ability of low- and moderate- income persons to purchase or rent such buildings, and the analysis of the estimated total energy savings (including the types of energy) to be realized from utilizing such standards in residential buildings. (P.L. 96-399) The assessment will compare an initial design to existing standards to a redesign to the interim standards. The government will pay for the redesign but not for the initial design or any construction.

Question: Where were the existing demonstrations of Federal residential standards undertaken and by whom? (p. 283)

Answer: The assessment of the Federal residential standards involve sites at Ellsworth AFB, Rapid City, SD (cold climate); Ft. Polk, Shreveport, LA (hot and humid); Ft. Irwin, Barston, CA (hot); Long Beach, San Pedro, CA (mild); and Browning, MT (very cold). These demonstrations are being conducted by DOE and its Pacific Northwest Laboratory with the cooperation of the services/agencies and installatio

Question: What have you found out through these demonstrations?

Answer: The demonstrations are still underway and conclusions have not yet been drawn. On completion of the demonstration project a report will be prepared and transmitted to Congress.

Question: How will the demonstrations to be initiated in 1991 differ from the previous ones?

Answer: The assessment of the Federal residential standards has focused on Federal agency use of those standards, and use by builders interacting with the Federal government in the housing procurement process.

The assessment of the voluntary residential standards for non-Federal use will focus on use of the standards in the private sector marketplace and address the impact of these standards on the cost of constructing housing and the impact of such cost on the ability of low- and moderate-income persons to purchase or rent such housing.

The approached planned for the demonstration of the voluntary residential standard will be patterned after the demonstration of the voluntary commercial building standard. A design competition is planned along with efforts to attract State, utility and private sector participation and cost-sharing.

Question: How does the "Interim Commercial Standards" demonstration work in 1990 related to the design initiative previously discussed?

Answer: The interim commercial standards demonstration work in 1991 is an assessment of the impact of the standards required by legislation (P.L. 96-399). It will assess the effect the standards have on the design, construction costs, and the estimated total energy savings (including the types of energy) to be realized from using the standards in commercial buildings. The results will be reported to Congress and used as the basis for promulgating final standards.

The accelerated building guidelines and standards demonstration will focus on the rapid adoption and use of the standards by State and local governments. The two activities are related. The assessment will provide insights in the design of the demonstration. And the demonstration will provide on the application and energy savings of the standard, but not within the time frame required for the initial report to Congress.

Question: What additional work will be done by increasing this work from $224,000 in 1990 to $800,000 in 1991?

Answer: In 1990, for $224,000, we will initiate the Interim Commercial Standards demonstration work to assess the impact of the standards on designers and on the design process for buildings in five climatic regions. We will also initiate the assessment of the impact of the standards on builders and on the cost of construction. This will involve setting up the assessment tools, identifying and selecting participants in each climatic zone, and doing the assessment in two to three zones.

In 1991, for $800,000, the assessments set up but not done in 1990 will be done and the assessment report will be prepared. In addition, detailed issues raised but not resolved in the demonstrations period will be studied. These will include an assessment of the lighting criteria in the standards that will go into effect in 1993, and a study of what subsequent changes are warranted to the storage water heater standby loss criteria. Several other lesser issues are expected to emerge. Criteria for each will be developed for the final standards. Finally, we will work with State and local jurisdictions, professional and trade organizations, and model code organizations to develop model code language and explanatory material to permit these and other criteria developed for the final standards to be promptly adopted and used.

Integrated Resource Planning

Question: Please explain how the expanded "Integrated Resource Planning" program differs from the current "Least-Cost Utility Planning" Program.

Answer: Our "Least-Cost Utility Planning" program has sought to encourage utilities and regulators to consider conservation activities and demand-side management alongside traditional energy supply options in order to provide utilities and consumers with cost-effective and reliable energy services. Least-cost utility planning has differed from traditional utility planning in that a broad array of demand-side programs are considered as resources.

Our Integrated Resource Planning (IRP) program will build on least-cost utility planning principles by encompassing all possible utility generating fuels and demand-reduction technologies, including comparative analyses of fuel cycle cost.

The DOE Least Cost Utility Planning program has focused mainly on utilities' electric planning processes and the assessment of demand-reduction technologies and program. Under the new IRP initiative, additional research topics will include regulatory rate changes for demand-reduction programs, environmental externalities, all-source bidding, demand-side management, technology assessment and market penetration, integrated resource planning for gas utilities, fuel choice and switching. In addition, the program will continue to support studies in the above topics by utility regulators and utilities, and enhance its information exchange program among the interested parties. The implementation of the results of this work can result in market force decisions that can simultaneously result in low economic cost to consumers and low environmental cost to society.

Question: What kind of plans are typical of the solicitations you expect to issue in this area in 1990, with funding from both fiscal year 1990 and 1991?

Answer: We are planning to issue a solicitation in 1990 seeking cost-shared projects in the areas of program performance, environmental externality methodologies, innovative rate structures, comparative fuel cycle cost analyses, and other IRP research topics.

Question: Will this program be expanded to gas utilities?

Answer: Yes, we are planning to explicitly include gas utilities in the Integrated Resource Planning (IRP) program. We have had preliminary discussions with the gas utility industry and the few states which are investigating gas IRP activities.

Question: Have gas utilities typically been involved in demand reduction planning?

Answer: No, typically they have not, basically because of the structural differences of the electric and the gas utility industries. Gas utilities are primarily distributors, not combined generator-distributors as are electric utilities, and therefore typically face different types of constraints for providing adequate capacity and for meeting service obligations. However, as a result of Federal Energy Regulatory Commission promotion of competition in the interstate natural gas market, a few state regulatory commissions have started to impose the application of demand reduction programs by gas utilities and least-cost purchasing requirements on local gas distribution companies.

Question: Why are they interested now?

Answer: State utility commissions are becoming increasingly active and assertive with respect to the gas purchasing practices of local distribution companies (LDC's). This activity is related to the activities by the Federal Energy Regulatory Commission to promote competition in the interstate natural gas market. As a result state commissions have begun to impose a variety of least-cost purchasing requirements on LDC's. Approximately thirteen state commissions have least-cost requirements for gas companies.

Question: Considering that most states are already involved in these kinds of programs, what new work will be done in designing regulatory incentives?

Answer: Although many states are interested in changing rate structures, only a few states are actually implementing changes. We will assist state regulators in evaluating rate changes, monitoring the impact of these rate changes (such as in California and in New York), providing technical support, and transferring the results to other states. We need to determine what works, how it works, and what actual impact occurs at the utility level. Proper regulatory changes can eliminate barriers to utility implementation of cost effective demand reduction programs and can result in market driven decisions that provide energy at both low economic cost and low environmental cost.

Question: How closely do you work with FERC in the regulatory area?

Answer: FERC has specific jurisdictional responsibilities in the electricity sector and in the interstate natural gas market. We have met with FERC staff to explain our program. A FERC staff member will be joining the DOE IRP steering committee to share in the information exchange that occurs in these meetings. Emphasis will be placed on a collaborative effort with FERC to identify and implement opportunities for integrated resource planning in their regulatory activities.

Question: Please explain what you mean by "environmental externalities."

Answer: Environmental externalities means a cost imposed by energy production that is not reflected in the price of the product. The full system-wide costs of these environmental impacts may not be considered in the utility planning process of evaluating supply-side and demand-side alternatives to meet utility needs and are not included in the development of rate structures. The term "environmental externalities" is used in conjunction with the quantification of the full costs of the environmental impacts that will occur from the implementation of each supply-side and each demand-side alternative. The quantification and consideration of "environmental externalities" by utility companies and utility regulators will help assure that the utility planning process will be based on a sound approximation of the total cost to society of each alternative.

Question: What will you do in this area?

Answer: We will be working with utility companies, State public utility commissions, State energy offices, other Federal agencies, and the national laboratories to identify, quantify, and integrate into the utility planning and regulatory arena the analytical tools and data required for more comprehensive energy decision making. DOE will be involved in methodology development related to total fuel cycle analysis, emissions measurement, and the valuation of environmental impacts including assessment of costs and benefits to assure that investments in integrated resource planning are cost effective. DOE will also examine the externalities of demand-side management activities and renewable energy technologies to assist in allowing market force decisions for utility energy savings to be based on the equitable treatment of supply-side and demand-side alternatives in the integrated resource planning process.

Question: What effect do these "externalities" have on the demand reduction process?

Answer: The consideration of externalities in the integrated resource planning process should have a positive impact on the contribution of demand-side alternatives. The primary effect of not including externalities is that energy production may be priced below its total cost to society by the value of the externalities. Energy efficiency measures and other activities that reduce demand will typically result in a lower externality cost than traditional supply options. The consideration of externalities will therefore tend to make demand reduction options more economically attractive.

Question: What kind of data are being collected currently on "demand-side management" activities by your organization?

Answer: We do not currently collect nationwide data directly on demand-side management activities. We do, however, have access to limited data which has been collected by other organization and from projects that we are funding. An example of an organization that collects this data is the Northeast Data Exchange (NORDAX), which shares information of demand-side programs among 19 Northeast utility companies. The Bonneville Power Administration has also been active in collecting, evaluating and sharing the results of its demand-side programs.

Question: By the Energy Information Administration EIA?

Answer: EIA for the first time this year, is collecting two types of demand-side management (DSM) data. One set of data will be filed through the EIA form #861, which is required to be completed by utilities of a certain size. These data will be collected and analyzed by fall 1990 and will provide us with information on which utilities are implementing DSM programs, along with an estimate of the savings expected from these programs.

The second set of data will be collected by EIA as part of its Residential Energy Consumption Survey (RECS). This survey will identify who is participating in utility-sponsored DSM programs. This data collection is being funded by the IRP program.

Question: BY FERC?

Answer: To our knowledge, FERC is not collecting information on demand-side management activities. We are reviewing with them their form on systems accounts to determine the appropriateness of gathering demand-side management data through that process.

Question: By Others?

Answer: The National Electric Reliability Council (NERC) collects utility-supplied data on an annual basis. Utilities have included estimates of demand-side management impacts on their future electric demands for only the last few years.

Question: Is it your intention to centralize data collection in any manner?

Answer: We are currently investigating with the cooperation of the Electric Power Research Institute (EPRI) and the Bonneville Power Administration the establishment of a National Data Center to collect and disseminate information on utility demand-side management programs and load shape data. If created, it would be our intent to provide seed money to establish the National Data Center. It would also be our intent that the utility industry provide subsequent funding for the operation of the center.

Question: Can EIA perform that function?

Answer: EIA can effectively collect some nationwide data through existing reporting mechanisms, and we have worked with EIA to collect certain demand-side management program information. The relevant EIA reporting mechanisms are the EIA Form 861, which is required to be completed by utility companies of a certain size, and the Residential Energy Consumption Survey. The use of EIA to collect, evaluate, and disseminate all of the national demand-side program information, however, may not be the most efficient and cost-effective approach. We are currently assessing various mechanisms for acquiring and sharing data and results on a State, regional, and national basis. The Northeast Data Exchange (NORDAX), which shares information on demand-side programs among 19 Northeast utility companies, is an example of a regional mechanism. We are also currently investigating, in coordination with the Electric Power Research Institute (EPRI) and the Bonneville Power Administration, the feasibility of establishing a National Data Center to collect and disseminate information on utility demand-side management programs and on load shape data.

Question: Unless data collection is somewhat centralized how can it be disseminated widely?

Answer: There are various mechanisms through which usable information on utility demand-side programs can be gathered, shared and disseminated. National and regional conferences on integrated resource planning are one such mechanism. Work that we have initiated with the National Association of Regulatory Utility Commissioners is another. Existing automated data bases will be supported and enhanced, where justified. Similarly new national or regional automated data bases will be supported, where justified.

Question: Whose function is dissemination?

Answer: In view of the overall public benefit that can result from less demand growth and consequent reduced impacts from new supply installations, governments at all levels have legitimate interests in encouraging and assisting utilities to promote energy efficiency and other demand reducing practices among their customers.

Questions: Have any evaluations been done on existing "demand-side" programs?

Answer: Yes. The Bonneville Power Administration has performed indepth evaluations of their conservation and demand-side programs since 1982. The cost of these demand-side programs is approximately two cents per kWh which, for BPA, is more cost effective than competing supply-side options. Less rigorous evaluations of demand-side management programs have been performed by a few other utlity companies. These evaluations have usually been limited in scope and performed in response to regulatory requirements.

Questions: If so, with what results?

Answer: The savings to date which BPA has measured from its conservation programs are equivalent to approximately 300 MW or nearly one-third of a conventional 1000 MW power plant. Similar savings have been measured as a result of regional conservation codes and standards. BPA is expecting to meet most of its likely load growth through 1997 with conservation, based on its experience in running conservation programs and the results of its program evaluations.

Question: What specific activities will you undertake in training, networking, and information dissemination?

Answer: We will continue and expand funding of national and regional conferences, workshops, and training and information dissemination efforts. Examples of past activities included two national conferences and five regional workshops hosted by the National Association of Regulatory Utility Commissioners; support and participation in conferences hosted by the Electric Power Research Institute EPRI, the American Council for an Energy Efficient Economy (ACEEE) and others; and a training course for regulators on Integrated Resource Planning. We will continue these efforts. Our current plan for FY 1991 is to fund four national conferences on IRP and one or two training seminars for regulators on specific topics related to environmental externalities and demand-side management programs and program evaluation. We plan to present papers summarizing results of research and participate in meetings, seminars, workshops and conferences hosted by others. We will continue the publication of a newsletter bi-annually, and distribute information from our research in the forms of publication, papers, and news articles.

Question: What training is necessary in this area?

Answer: Based on attendee input from the technical training workshop hosted by the Lawrence Berkeley Laboratory, the National Association of Utility Regulatory Commissioners, the Electric Power Research Institute, and others, there is a significant need to provide instruction in the measurement and evaluation of demand-side management program impacts and in planning techniques. Also, there continues to be a substantial need for the transfer of technical information to utility companies and commission staffs.

Question: Who will do it?

Answer: Conference will be hosted by the National Association of Regulatory Utility Commisioners, the Electric Power Research Institute (EPRI), utilities and others, independently and jointly. The regulators' training will be held at Lawrence Berkeley Laboratory. Papers, publications and presentations for conferences will be prepared and conferences will be attended by DOE staff, laboratories experts, and DOE grantees and contractors. We anticipate a multiplying effect will occur, from the national laboratories to selected groups, who will then share their knowledge with their regional colleagues and institutions through peer meetings and more specialized conferences.

Question: What will you do in networking?

Answer: We plan to expand the network of participants in the program. Internally the DOE regional offices, the Power Marketing Administrations, and the Federal energy management network will participate in the program implementation. Externally we will increase our contact with the gas utilities, the renewable energy industry, the State energy offices and the utility cogeneration, transmission and regulatory interest groups. We will also continue to expand our regional contacts.

Energy Analysis and Diagnostic Centers

Question: Please explain how many more audits per year will be able to be done with an expanded Energy Analysis and Diagnostic Center program?

Answer: The audit capacity for FY 1990 is 360 audits per year. Basically each new EADC conducts an additional 30 audits per year. While we plan to have three additional schools selected for the FY 1990 period they will have no opportunity to contribute to the FY 1990 audit work. FY 1991 audit capacity will be 480 audits per year.

Question: What new areas of the country do you expect to be able to cover?

Answer: The current thirteen participating universities serve parts of 35 States. The areas served by the next six schools added to expand the program will depend on the geographical locations of the selections made during the competitive solicitation process. The solicitation seeks proposals from schools throughout the continental United States, and closes July 7, 1990, with awards targeted for the August - September time frame.

Question: How will the additional schools be chosen?

Answer: Schools will be selected in response to competitive solicitations conducted by the Program Field Manager, University City Science Center in Philadelphia, PA. The initial solicitation has been sent to the Dean of Engineering and major Department heads at all schools with accredited programs in engineering/ engineering technology in the continental United States. The solicitation will close July 6, 1990. At this time six prospective EADCs will be selected -- three for the FY 1990 period, and three for the FY 1991 period.

Question: What training is involved in the initiative and how much will it cost in 1990 and 1991?

Answer: Current plans are for each new EADC Director and Assistant Director to be sent to a four day training class at the Colorado State University, at Fort Collins, CO. Class size is limited to the number of people that may be conveniently taken on an actual plant audit in one plant facility. Six trainees and the Colorado State audit team guiding the work are the maximum that can be accommodated in a single plant audit. The cost of training at Colorado State for the 12 people selected in FY 1990 and FY

1991 is $30,000. The first year audit work load is limited to 15 audits rather than the 30 audit load of a fully operational school. All audit reports are critiqued by the field manager, with follow up visits to client firms by field manager personnel. Subsequent confirmation of the implementation of audit recommendations is made by the school during the twelve month period following submission of the schools audit report to the client firm.

Question: Explain how this program is managed by the University City Science Center?

Answer: The University City Science Center, competitively selected as the field manager for the Energy Analysis and Diagnostic Center program, manages the program under a cooperative agreement with the Department of Energy. This agreement expires in September 1992.

The field management responsibility of the University City Science Center is defined in the scope of work. This includes direct oversight of the operations at all Energy Analysis and Diagnostic Centers, conducting competitive solicitations, screening of candidate schools for the program, and scheduling orientation and training for new EADC schools. Science Center professional staff review in detail every energy audit report and prepare a critique of it for the EADC; periodically Science Center staff accompany EADC staff during an energy audit in a plant; and twice a year Science Center staff interview in person about 60% of the manufacturers served to evaluate each ETC's performance.

Question: Do you expect to continue this method of management?

Answer: With the planned major expansion of the Energy Analysis and Diagnostic Center program; changes in how the program is managed are going to be needed as the program continues to grow. Program management responsibilities are defined in the scope of work for the EADC program management. Planning for the competition for management of the Energy Analysis and Diagnostic Center Program following the FY 1992 period will be started during the latter part of FY 1990. This lead time is necessary to permit selection award and phase in of any changes in procedures or management as the FY 1992 award expires. Evaluation of management planning for the program will be an ongoing activity during the FY 1990-91 period.

Transportation Conservation

Question: Two questions generally arise in conjunction with new transportation technologies; first, efficiency of energy use, because of dependence on oil imports; and second, emission control either by engine technology or by fuel substitution. Is it correct that all the engine or propulsion technologies being developed are both more efficient and cleaner than current technologies?

Answer: All propulsion technologies under development and related to transportation support both higher efficiencies and cleaner exhaust. For example, gas turbine development is aimed at both higher efficiencies (mpg) and lower exhaust emissions (without exhaust aftertreatment). Another example is our tribology research on diesel engines which aims at developing lubricants that can perform at higher temperatures compared with conventional oils. This development can lead to engines that reliably operate at higher temperatures with improved fuel economy and with attendant lower particulates in the exhaust. Current research on high temperature materials (ceramics) will impact the auto industry within the next five years with ceramic component engine parts replacing steel parts even at lower temperatures. The resulting lighter weight engines and lower mass parts will improve vehicle efficiency and exhaust emissions.

Question: In your judgment what propulsion technologies are most likely to have immediate impact versus longer term impact?

Answer: Alternative-fueled versions of current engine designs will have the most immediate impacts. Electric vehicles in some limited fleet niche applications are also expected to have some immediate impacts. Gas turbines, advanced diesels, and improved range electric vehicles will have impacts in the mid-term (1995-2000), and fuel cell technologies in the long term.

Question: Is there serious automotive interest in all of these technologies? Who is interested in each? For example, a Washington Post article of April 19, 1990 indicates General Motors' intent to manufacture electric vehicles in the near future. A Washington Star article of February 8, 1980 is remarkably similar.

Answer: There is definite industry interest in all of these technologies. Both Ford and Chrysler are involved in our electric vehicle programs and, along with General Motors, are seriously considering limited production. General Motors and Allied-Signal are involved in the gas turbine development effort, and both companies are spending internal funds on commercialization applications. Our advanced heavy duty program includes Caterpillar, Cummins, and Detroit Diesel as participants, and each of these companies has already introduced some of the developed technology incrementally into their production engine designs. All of the work with industry is cost shared, another measure of serious interest.

Question: What has to happen for such manufacturing to take place?

Answer: Several technology barriers remain before such manufacturing takes place. In the case of electric vehicles, a longer life, higher energy density battery is still required before major commercialization activities occur. In the case of the gas turbine. the challenge of ceramic component performance is being resolved, but both cost and reliability still must be improved.

Question: Are CAFE standard incentives needed? (Are they in place?)

Answer: Regulations are in place that allow the industry to receive CAFE credits for the manufacture and marketing of electric vehicles. The equations for the calculation are published in 10 CFR Part 600 and the fuel economy equivalency factors are published in 10 CFR Part 474. The Department of Energy is in the process of updating the fuel economy equivalency factors and they will be published in the Federal Register later this year.

The Alternative Motor Fuels Act of 1988 established CAFE credits for automotive manufacturers for the production of alternative fueled vehicles. These incentives apply to both dual-fueled and dedicated alternative fuel vehicles.

CAFE standard incentives should be productive during the introduction period when the market for vehicles and the fuels infrastructure are still being developed.

Question: Must Clean Air legislation be in place?

Answer: The ambient air quality standards being proposed are definitely having a major impact on the automotive industries' long range planning. More effort is being placed on alternative-fueled vehicles and multi-fueled efficient propulsion systems even though gasoline prices are very low and are not projected to increase significantly in the near term. Clean Air legislation may be an important ingredient leading towards accelerated introduction of technologies into the marketplace.

Question: What provisions assist electric vehicle makers?

Answer: Electric vehicle makers can benefit from the CAFE credits for electric vehicles and the ambient air quality standards for volatile organic compounds (VOCs), carbon monoxide (CO), and oxides of nitrogen (NOx). Studies indicate that electric vehicles will reduce VOCs and CO by over 95 percent and NOx by over 60 percent.

Question: Are other incentives necessary?

Answer: The successful commercialization of electric vehicles, as well as any other clean fuel vehicle, will require a sustained market demand. An incentive to manufacture by itself may not be sufficient. Consumer related incentives may also be necessary in some areas until the technology becomes fully mature and is broadly accepted by the consumer.

Question: In the case of electric vehicles, are they actually more energy efficient or less polluting when power generation energy use is considered?

Answer: The electric vehicles under development by General Motors (the Impact) and DOE are more energy efficient and pollute less than conventionally powered vehicles. The efficiency of current technology vehicles, such as the General Motors G-Van, are approximately equivalent to conventional vehicles of similar size and weight. This efficiency includes all losses in generating the electricity at the electric utility and the transmission of the energy to the household outlet. As for emissions, studies by the Electric Power Research Institute (EPRI) indicate that electric vehicles will produce approximately one percent of the hydrocarbons and carbon monoxide emissions for equivalent gasoline powered cars, and produce nearly fifty percent less oxides of nitrogen and carbon dioxide. Sulfur dioxide could increase if the utility is using coal for generating the electricity.

Question: The Government has invested considerable funding in turbine, diesel, and electric vehicle technology and is expected to continue to do so. We have begun to fund automotive fuel cell work also. What is your opinion of the likelihood of these technologies actually being commercialized by the automotive sector?

Answer: Which technologies will actually be commercialized by the automotive sector is based on a wide range of economic, environmental, and competitive factors. However, each of the technologies present options for major improvements in fuel economy, performance, fuel flexibility, and emissions and it is expected that many, if not all, will be commercialized for markets where they demonstrate cost-effective benefits.

Question: What would be the effect if Government funding were not available? Are there other technological benefits to this work not directly related to automotive use?

Answer: If Government funding were not available to conduct R&D programs in transportation, it is not clear whether U.S. industry would allocate sufficient resources to continue the research and development efforts. Most of the U.S. automotive R&D is focused on relatively near-term problems.

There are many technological benefits to the work not directly related to automotive use. The gas turbine developments are applicable to aircraft engines, stationary power generation, auxiliary power units, and a wide variety of military applications. The ceramics technology developments have application in any energy conversion system, and in a broad spectrum of equipments where friction, wear, life, corrosion, strength, mass, temperature, etc., are important.

Turbines

Question: Have the basic arguments changed from last year?

Answer: The basic arguments have not changed from last year. Only one engine design is required to prove the concept, and most of the basic technology development has already been accomplished.

Question: How much funding would be required to continue both contractors?

Answer: The funding request for two contractors would be $13.5 million as the Government share. The contractors would contribute an additional 20 percent as a direct cost share.

Question: Are they both still interested?

Answer: Both contractors are still interested in continuing this research and development program. Each has and continues to add to the program various related work beyond their immediate cost sharing.

Question: What are their commercialization plans?

Answer: Although industry keeps commercialization plans proprietary for competitive reasons, it is known that both contractors are investigating specific vehicle styles for testing and possible production. One commercialization scenario that has been considered would result in limited production as early as the mid 1990s. A reasonable prediction would be production by at least the late 1990s.

Question: Is either interested in stationary applications?

Answer: Both contractors are involved in R&D for stationary applications and have been for some time. The ceramic studies/results from the automotive gas turbine program are directly applicable to stationary turbines. Allison has shown in a recent study that the incorporation of ceramic vanes and blades in the first two turbine stages of their 501-K34 industrial engine (5,815 hp) could yield a reduction in specific fuel consumption of 6 percent and an increase in power of 13 percent without changing turbine inlet temperature. These are major improvements and a source of significant interest to

Allison/GM. Garrett has an ongoing, internally-funded study to examine the advantages of applying ceramics to stationary turbines. Garrett produces stationary power gas turbines in the 600 kilowatt class.

Question: Is the work in this program directly applicable to stationary applications?

Answer: While the automotive gas turbine work is focused on relatively small shapes, the generic technology nature of the developments is applicable to stationary and other types of gas turbine engines. For example, much generic ceramic processing technology is being developed: injection molding, slip casting, process modeling, and non-destructive evaluation techniques to name a few. The statistical component modeling and analysis techniques are also generic as is the material characterization database. These technologies all directly apply to stationary gas turbines.

Question: In addition to direct cost-sharing, what other activity do these firms engage in which supports the program?

Answer: General Motors (GM) maintains a continuing staff at the GM Technical Center directed at automotive gas turbine development and not funded by the DOE program nor claimed as cost sharing. These staff people address engine design, development and testing, installation of experimental engines in vehicles, emissions testing, machining, and technical staff support. GM continues to make capital investments paralleling and benefiting the automotive gas turbine program in the area of test facilities and equipment. Significant computer analysis costs are also borne by GM. Multiple sets of engine blocks and powertrain hardware owned by GM are being utilized as demonstrators in the effort. Garrett has also expended internal funds in the areas of laboratory equipment, machining equipment and facilities support in addition to funding ceramics studies necessary but not covered by DOE funds.

Heavy Duty Diesel

Question: What is the status of heavy duty diesel technology?

Answer: The major contractual efforts are with Cummins and Caterpillar to develop in-cylinder components and applied tribology for an engine that will meet the program goal of a fuel consumption of 0.25 lb/bhp-hr. The phase I effort of these contracts completed a detailed cycle analysis and validated the engine design capability to meet the fuel consumption goal. Preliminary investigations of the RAPRENOX technology developed under the ECUT program has shown NOx reductions up to 90 percent. The first formulation of the high temperature liquid lubricant has shown a 50 percent reduction in oil consumption which will greatly reduce particulate emissions. Technology from the thick thermal barrier coatings work at Caterpillar and Detroit Diesel has been utilized in their limited production engines.

In-cylinder components testing in single-cylinder test rigs will begin in 1992. Demonstration of the program goal with emission standard compliance is planned for 1997.

Question: What are the specific goals of the program?

Answer: The program fuel economy goal is a brake specific fuel consumption (BSFC) of 0.25 lb/hp-hr. This compares to BSFC of 0.35 typical of production engines at the program's inception in 1982. The emission goals are to meet or better projected 1994 standards of 5.0 grams/hp-hr nitrogen oxides and 0.1 grams/hp-hr particulates. The durability goal of alternative fuel diesel engines is to maintain the current standard of conventionally-fueled diesels of 10,000 hours or more.

Question: What are the main remaining technical problems?

Answer: The following list represents the major technology problems associated with efficient, low emission advanced diesel engine development:

- Improved durability (>10,000 hours) of low heat rejection thick thermal barrier coatings
- High temperature, low ash, low oil consumption liquid lubricant
- Better understanding of combustion and emission formation to reduce nitrogen oxides and particulates
- Effective combustion with natural gas and methanol fuels
- Practical reliable aftertreatment schemes for nitrogen oxides or particulate reduction
- Improved fuel introductory and air management equipment (injectors, variable geometry turbochargers, electronic controls, etc.)
- Improved ring-pack design with minimal oil consumption
- Technology integration into emission standard compliant engine systems

Question: When will full engine be tested?

Answer: Present contracts under the Heavy Duty Transport Technology Program are limited to component development and integration in single-cylinder engine test rigs. Accurate emissions/performance test measurements require multi-cylinder engine tests which are planned for the 1995 time frame.

Question: Will such engines be able to satisfy stringent emissions control requirements?

Answer: The multi-cylinder engine integrating program technology has the potential for demonstrating the stringent emission standards; however, emission standards compliance may incur some fuel penalties.

Question: Please quantify emission expectations versus regulatory requirements?

Answer: The following is a list of technologies which could contribute to lowering engine emissions. These technologies require effective integration into engine systems and do not necessarily contribute in an additive manner.

- o Conventional mineral lubricating oils contribute an average of 25 percent of particulate emissions. New high temperature synthetic liquid lubricants have the potential of reducing this contribution by 70 percent.
- o Relocation of top ring nearer the top of the piston, as permitted by the use of a high temperature lubricant, can reduce the fuel contribution to emissions by 5 to 10 percent.
- o Thermal barrier coatings allow sharp contours and shapes of the piston combustion bowl for improving combustion. When combined with high pressure fuel injection equipment, gains of up to 10 percent in nitrogen oxides and 20 percent in particulate reduction are possible.
- o Fuel injection equipment with higher fuel injection pressure (30,000 psi) and rate shaping could reduce nitrogen oxides by 25 percent.
- o EPA requires a 290,000 mile life for exhaust particulate trap/oxidizers to meet 1994 particulate emission standards. The best current particulate trap life is about 50,000 miles. Improved trap materials hold the potential for meeting the EPA life requirement.
- o The RAPRENOX exhaust treatment concept with appropriate conversion system and controls for transients could reduce nitrogen oxides by more than 50 percent. Current tests under steady state conditions show nitrogen oxides reductions up to 96 percent. Nitrogen oxides treatment could allow engine optimization to reduce particulate emissions with an attendant 5 to 10 percent improvement in fuel economy.

The program is directed at compliance with the 1994 EPA nitrogen oxides and particulate standards for heavy duty diesel engines. These standards are a 5.0 g/hp-hr nitrogen oxides limit and 0.5 g/hp-hr for particulates. Since all production engines must meet these standards, more stringent engineering standards must be used to account for variations in production design tolerances and wear. Therefore, to ensure compliance of all production engines, the program emission goals are 80 percent of the 1994 emission regulation standards.

Engine emission of carbon dioxide is a primary factor in the "greehnouse effect." Carbon dioxide is not currently regulated. Its generation is essentially directly related to engine efficiency. Since the diesel engine is the most fuel efficient engine in the marketplace, and the program further improves the fuel efficiency, the carbon dioxide emissions will be commensurately reduced.

Question: Does the FY 1991 budget request keep the program on schedule or slow it down?

Answer: The FY 1991 budget request is adequate to keep the present program on schedule barring unanticipated technical or programmatic problems.

Electric Vehicle Propulsion Systems

Question: Describe the modularized vehicle component program with Ford. (p. 362)

Answer: The objective of the Modular Electric Vehicle Program is to advance electric vehicle technology towards commercialization by modularizing the components and making them suitable for use in a range of vehicle sizes from a small two-passenger car to a full-size van. Special emphasis will be placed on modularization and integration of components to minimize the number of variations and allow families of components to be developed from a common design. The program will combine the best features of the previous ETX programs and work closely with battery manufacturers to develop suitable battery systems. Three modular propulsion systems in the 50, 75, and 100 horsepower sizes will be delivered in three different size testbed vehicles to DOE at the completion of the program. This approach of making components suitable for a wide range of vehicles allows manufacturers to achieve economies of scale sooner and moves the technology closer to commercialization.

Question: How long will it take to complete?

Answer: The Modular Electric Vehicle Program (MEVP) is a full four-year program spread over five fiscal years. The program consists of four phases: Phase 1) preliminary system design and trade-off studies, Phase 2) component design, Phase 3) component build and test, and Phase 4) system integration and test.

Question: What funding is necessary by year, to do this?

Answer: The total project cost, estimated cost sharing, and estimated Federal cost, by fiscal year, is shown in the following table:

($ in millions)

	FY 90	FY 91	FY 92	FY 93	FY 94
Federal Cost	2.5	2.5	6.3	2.8	1.0
Cost Share	0.5	0.5	1.1	0.6	0.2
Total Cost	3.0	3.0	7.4	3.4	1.2

Question: What kind of advancements are expected under this program?

Answer: The expected advancements are as follows:

- o Modularizing components provides cost reduction potential.
- o Integration and simplification of system controls moves technology closer to commercialization.
- o Provides battery subsystem engineering of maturing battery technologies.
- o Develops needed auxiliary subsystems, e.g. power steering, heating and air conditioning, and power brakes.
- o The modular propulsion system development will be utilized by the manufacturer for a corporate vehicle development effort of a fleet of vehicles.

Question: How does this work complement or advance technology being used in the General Motors G-Van and the Chrysler T-Van programs?

Answer: The General Motors G-Van and the Chrysler T-Van are both direct current (dc) propulsion systems. The Ford system is an advanced alternating current (ac) propulsion system. This drive system is expected to be more competitive with the internal combustion engine in both performance and cost than the dc system.

Question: The Ford program is an ac current system. General Motors is using a dc system in its proposed "Compact" vehicle. What are the advantages and disadvantages of each.

Answer: General Motors' proposed compact electric vehicle, called the "Impact," uses an ac propulsion system. The ac drive system is positioned to compete with the internal combustion engine vehicle by the mid to late 1990's. The cost of high power electronics used in ac systems is coming down in price and will make an ac propulsion system less costly to produce and maintain than a dc propulsion system. Another important factor for developing ac systems is that the motor is smaller, less costly to produce, and more reliable than a dc motor. At the time the decisions were made by GM and Chrysler to produce electric vans, such as the G-Van and T-Van, dc systems were the only ones available.

Electric Vehicle Batteries

Question: The 1991 budget proposes $3,600,000 for battery research, a reduction of $4.3 million below 1990. (p. 361) The budget is limited to three batteries. For each (sodium-sulfur; zinc-bromine; lithium-metal sulfide) what manufacturer interest is there in the battery?

Answer: The following table provides list of manufacturers and extent of their interest in battery technology development:

TECHNOLOGY	DEVELOPERS	INVOLVEMENT
Sodium-Sulfur (Na/S)	Chloride Silent Power, Ltd., England and its U.S. subsidiary Beta Power, Inc.	Current DOE contractor for development of Na/S EV battery with 15 years EV commitment. Pilot plant is being built with company money. Strong manufacturing team.
	Asea Brown Boveri, Germany joint venture with Magna International: Powerplex Technologies, Inc., Canada	DOE purchased a Na/S battery for the ETX-II vehicle. Built in excess of 100,000 cells and 200 24 kWh batteries installed in EVs. ABB has a small pilot plant facility.
	Hughes Aircraft Co.	Commitment to high power bipolar battery and has an Air Force development contract. Owned by General Motors.
	Eagle-Picher Industries, Inc.	Fabricated Hughes Air Force and space industry Na/S cells. Established domestic Na/S cell and battery supplier. Involved in EV program since the 60's. Ceramic electrolyte lab.

	Yuasa Battery Company, Japan	Load level application, 300Ah Na/s cell, 30,000 cells for one megawatt battery.
	NASTECH, joint venture with Asea Brown Boveri and NGK Insulator, Germany	Produced 70 Wh, 50 kW battery for EVs and and 400 Wh cell for load level application, currently producing 80 cells per day.
Lithium-Metal Sulfide (Li/MS)	SAFT America, Inc.	Current DOE contractor for development of Li/MS battery. World wide talent pool.
	The Electrofuel, Mfg. Co., Canada	Engineering cells, market oriented low-cost approach for cell development, small production facility.
	Eagle-Picher Industries, Inc.	Involved in EV program since the 70's. 30-plus years of thermal battery R&D and production experience.
	Westinghouse Electric Corp.	Engineering cells, related military systems, cell technology and fabrication facility. Corporate commitment is unclear.
Zinc-Bromine (Zn/Br)	Johnson Controls, Inc.	Current DOE contractor for development of EV battery. Cost shares 18% of development of sealed Zn/Br battery. Recently fabricated 8 kWh module for test by DOE laboratory. Earlier designs indicated potential for EV application.

Energy Research Corp.	Previous DOE contractor for development of load-leveling Zn/Br battery. Tested 1.4 kWh modules up to 350 cycles.
SEA (Austria)	Foreign developer. 5 kWh module purchased for test at DOE laboratory. Test results show 175 cycles of stable operation. Technology would support EV range of 90 to 110 miles.

Question: What are the problems remaining to be solved for each of the batteries?

Answer: The following problems remain to be solved:

- o Sodium-sulfur--increase freeze/thaw cycle life, increase calendar life, reduce corrosion initiated cell leaks, optimize weight and size, and reduce manufacturing costs to that of lead-acid.
- o Zinc-bromine--enhance specific power and life, refine vibration, welding techniques, and scale up to a 50 kwh vehicle battery system.
- o Lithium-metal sulfide--enhance specific power and life, reduce cost, increase reliability of hermetic seals, and optimize thermal management.

Question: For high temperature, corrosive batteries will disposal, warranty, and liability be problems?

Answer: Shipping, crash worthiness, and disposal issues for sodium-sulfur batteries were recently addressed in a DOE-sponsored meeting of key interests including manufacturers, government regulatory agencies, vehicle manufacturers, and the insurance industry. All options for disposal were explored including landfill, incineration, and recycling. The batteries have chromium sulfides that are classified by EPA as toxic wastes. These can be disposed of by incineration. Ultimately reclamation is the preferred method and could be the most cost effective approach. No serious warranty or liability problems are foreseen, but further study is needed to assure this.

A hazard assessment of the management of waste lithium from batteries such as the lithium-metal sulfide battery was sponsored by EPA in 1983. Batteries were evaluated for products of reaction between cell constituents and water or heat, and disposal practices were surveyed.

In general, published toxicity data and results of abuse tests are incomplete.

Question: How does your program address this?

Answer: Each area of concern raised at the recent DOE sodium/beta battery meeting on shipping, crash worthiness, and disposal is being assigned to an appropriate (ad-hoc) task force team for resolution in conjunction with the appropriate regulatory agency which is represented on each team.

Disposal, warranty, and liability issues for lithium-metal sulfide batteries are being investigated by the DOE contractor and are included in studies currently sponsored by DOE at the Solar Energy Research Institute (SERI).

Question: On present schedules when could production batteries be available?

Answer: On present schedules, production of batteries could be available as follows: sodium-sulfur--1994, zinc-bromine--1996, and lithium-metal sulfide--1995. A recent development for possible commercialization, manufacture and marketing of sodium-sulfur batteries is an Anglo-German joint venture between the Chloride Group PLC and the West German RWE AG utility company. The intention is to stimulate development of the market for sodium-sulfur batteries with a view to expansion into full-scale production.

Question: Would additional funding accelerate battery development?

Answer: The focused battery technologies for electric vehicle applications are being developed on a planned schedule and any additional funding would not be cost effective.

Question: If so, please explain and quantify.

Answer: Additional funding is not required.

Question: Are there other promising batteries?

Answer: There are other battery options such as sodium-metal chloride, nickel-metal hydride, zinc-air, nickel-zinc, iron-air, advanced lead-acid, nickel-iron, and the ultracapacitor. However, the batteries considered most likely to succeed are the sodium-sulfur, zinc-bromine, and lithium-metal sulfide.

Question: Are there any batteries outside of the DOE program that are being pursued actively by battery manufacturers?

Answer: The rechargeable lithium battery technology which consists of secondary batteries utilizing lithium as the anode material is being pursued by battery manufacturers. A number of different cathode materials and electrolytes are being evaluated in conjunction with the lithium. These chemistries hold out the promise for increasing the energy available in a cell by a factor of three or more when compared to rechargeable nickel-cadmium cells. Technical challenges in areas such as safety and cycle life have limited the success of every effort to develop rechargeable lithium batteries.

Question: Are there advances that could be made to lead-acid batteries?

Answer: Lead-acid batteries have the potential to reach higher energy densities than are available from batteries on the market at the present time. However, current prototypes of these advanced batteries do not have adequate life to be a viable product. Additional potential exists to combine high energy density with a low maintenance sealed design. Since lead-acid battery technology is relatively mature, however, these advances are within the reach of commercial battery manufacturers without Federal assistance.

Question: Please explain how GM can claim good performance and range with lead-acid batteries.

Answer: The GM Impact vehicle obtains good performance and range because of its improvements in vehicle technology. The vehicle design has low aerodynamic drag and low rolling resistance. In addition, the vehicle structure is light so a high fraction of the total vehicle weight (40 percent) is in batteries. Thus, the vehicle energy consumption per mile is low, and the high battery fraction gives improved range. The battery and propulsion system design are optimized for high power to give good acceleration (performance).

Question: Is this a saleable battery?

Answer: The GM battery appears to be similar to other sealed lead-acid batteries evaluated by DOE and the Electric Power Research Institute. These batteries are utilized in current electric vehicle fleets because the sealed design minimizes maintenance. However, the life of these batteries is short. In more conventional electric vehicles, range will be limited to 40 to 50 miles.

Electric Vehicle Test, Evaluation, and Demonstration

Question: Explain your test and evaluation program at Idaho National Engineering Laboratory.

Answer: The laboratory testing at INEL is divided into three sections: the dynamometer lab, the battery lab, and analytical assessment. The dynamometer lab evaluates electric vehicle performance with respect to several driving cycles including constant speed, Federal Urban Driving Schedule (FUDS), SAE defined J227a C and D cycles, gradeability, and acceleration. The evaluation extends to the component level, commenting on specifics of the motor controller, charger, auxiliary power supplies (12-volt systems), heating and air conditioning, and system and operator controls. The battery lab supports vehicle testing as well as performing independent tests on available battery systems. The INEL battery lab is generally concerned with characterizing the battery, that is, defining its energy storage capacity and power capabilities under the varying conditions seen in the different driving cycles. Life testing of the batteries is being performed on a selective basis due to the testing time requirement (6 months to 2 years per battery) and the availability of test equipment. Specialized testing, such as vibration and gas ignition, has been performed when the properties of the specific vehicle or battery emphasize the need. The analytical assessment function translates the laboratory data into real world relational information that can provide range, performance, and cost projections for the particular equipment. Computer simulation performed by this section models vehicles, batteries, and subsystems to project combinations of technology that can meet expected range and performance requirements.

Question: What specific batteries or systems are tested?

Answer: The INEL battery lab generally tests mature batteries of both foreign and domestic origin. The batteries have been identified for use in a vehicle by a specific manufacturer or are identified by INEL as having a particular quality that may be applicable to electric propulsion. Occasionally, R&D level batteries will be tested at INEL for modeling or comparison to other laboratory testing.

Question: How and whom are results disseminated?

Answer: The results are published in an informal report form and copies are sent to the corresponding departments at other national labs and research organizations. Barring manufacturer proprietary restrictions, the reports are available to the public either directly or through NTIS. The information is also disseminated through presentations made to various public and private organizations.

Question: What part does this capability play in overall electric vehicle technology development?

Answer: The proper identification, evaluation, and documentation of current technology applicable to electric vehicles educates the developers on existing technology that may be applicable to their particular research and provides an assessment of their progress. It also provides the manufacturer and potential consumer with an unbiased evaluation of the vehicle, component, or battery system.

Question: Who else has similar capabilities?

Answer: Both the Sandia and Argonne National Laboratories have battery testing capabilities and are being used to test research level battery systems. Electrotek Concepts, Inc., sponsored by the Electric Power Research Institute (EPRI), provides track testing capabilities (1 mile oval) up to 55 mph and limited battery life and component testing. Electrotek's work is in support of the EPRI electric vehicle program.

Question: Whose light-weight permanent magnet motor are you testing?

Answer: INEL expects to test both the Ford ETX-II (developed in the DOE program) and the Unique Mobility drive system in the near future. The ETX-II will be tested as a complete vehicle and the Unique Mobility system will be tested on the component level as motor/controller combination.

Question: What are its advantages.

Answer: The permanent magnets replace a set of wire coils that are used in a typical alternating current or direct current motor to provide an internal or external electromagnetic field. The major advantage is in the motor controller, where the electronics used to control the voltage and current in the wire coil of a standard motor design can be eliminated.

Site Operators' User Task Force

Question: How many vehicles of what kind were purchased, or are to be purchased in 1990?

Answer: The site operating program will be cost sharing the purchase of 34 GM G-Vans and 2 Unique Mobility vans for a total of 36 electric vehicles in fiscal year 1990.

Question: Where will the vehicles be located?

Answer: The vehicles will be located as follows:

NEW ELECTRIC VEHICLE LOCATIONS

SITE OPERATOR	LOCATION	QUANTITY
Southern California Edison	Los Angeles, CA	20 GM G-Vans
L.A. Dept. of Water & Power	Los Angeles, CA	2 Unique Mob
Arizona Public Service	Phoenix, AZ	5 GM G-Vans
York Tech/Duke Power	Rock Hill, SC	2 GM G-Vans
U.S. Navy	Bermuda	3 GM G-Vans
Site/s to be Named		4 GM G-Vans
	TOTAL	36

Question: What was the cost of each?

Answer: The cost of the vehicles are shared at approximately 50 percent each, between the site operator and DOE. The total cost of each type of vehicle is:

Vehicle	Total Cost
GM G-Van	$32,500*
Unique Mobility Van	$70,000*

*The GM G-Van is a production vehicle, produced in sufficient quantities to drastically reduce costs. The Unique Mobility van is produced for special orders only. The quantities produced are so limited that costs are substantially higher.

Question: Do you have any plans to purchase additional vehicles in 1991?

Answer: The Site Operator Program plans to procure approximately 20 new vehicles with the funds requested in FY 1991.

Question: Are there any electric vehicle demonstrations being undertaken by others? If so, describe them.

Answer: The Electric Power Research Institute (EPRI) is supporting the development and manufacture of the General Motors G-Van by the Vehma Corporation in Toronto, Canada. The marketing arm of EPRI, the Electric Vehicle Development Corporation, is soliciting buyers for these vehicles primarily through electric utilities. Some of the utilities involved are associated with the Department of Energy's Site Operator Program and DOE is cost sharing in the vehicle purchase.

Question: The Los Angeles Department of Water and Power issued a procurement document requesting suppliers for electric vehicles. What manufacturers responded?

Answer: It is our understanding that a total of nine companies responded with proposals to the Los Angeles procurement. Although we do not have the complete list, Unique Mobility in Englewood, Colorado, Vehma Corporation in Toronto, Canada, and CAT Holdings (a joint UK-Swedish venture) were the three companies selected.

Question: Are any vehicles being purchased based on this solicitation?

Answer: The solicitation did not provide for the direct purchase of vehicles. The intent is to help the manufacturers market, finance, distribute and maintain the vehicles. It is our understanding that the program is still in the initiation stage.

Question: In general there seems to be no natural market for an expensive, short-range vehicle (electric vehicle). What markets do you see developing initially and what kinds of incentives must be offered, or regulations put in place, in order to develop electric vehicle markets?

Answer: The most likely initial markets are the fleet users. Many of these vehicles are assigned to fixed routes that can be carefully selected so that the range and performance requirements are compatible with the present vehicle technology. In addition, fleet users are much more sensitive to life cycle cost where an electric vehicle can be very competitive in spite of its higher initial cost. Incentives for both the manufacturer and consumer may be necessary until the technology is developed to the point where electric vehicles are more competitive in performance and initial cost. For industry, the CAFE credits are providing an incentive, especially if the CAFE requirements for gasoline powered vehicles continue to increase. Also, increasing the air quality standards is requiring many of our metropolitan areas to consider incentives for low emission vehicles such as electrics.

Question: What areas in which you provide funding do you think will have the most impact on developing a marketable electric vehicle?

Answer: The major impediment to the successful commercialization of electric vehicles at the present time is a low-cost, reliable battery that can provide satisfactory performance over the life of the vehicle. Our present development effort is focusing on batteries with the potential for low cost, high performance, and long life. The development of an integrated propulsion system that is efficient, reliable, and inexpensive to manufacture is also necessary. The Modular

Electric Vehicle Program (MEVP) that is presently being negotiated could achieve this objective. In the long term, our fuel cell technology programs have the potential for providing an extremely low emission vehicle with virtually unlimited range.

Question: Do you think small entrepreneurial manufacturers have a significant role in this area, or is electric vehicle introduction essentially dependent on the major automobile manufacturers?

Answer: The development, manufacturing, marketing, and servicing of an automobile that will have broad public acceptance requires huge amounts of capital and experience. The automobile industry is an extremely competitive area and it is nearly impossible for the small entrepreneur to successfully compete. The vehicles that were provided for the Market Demonstration Program of the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976 (Public Law 94-413), were mostly produced by small companies. Without exception, these vehicles suffered from poor reliability, unavailability of parts, and general poor performance. The overall experience was very unsatisfactory and the customers were extremely displeased. As a consequence, the manufacturers failed rapidly leaving the vehicle owners with no warranties or source for maintenance support and spare parts.

Electric Vehicle Fuel Cells

Question: What is the status of the fuel cell bus program?

Answer: The project is proceeding as originally planned. The Phase I effort, Proof-of-Feasibility, has been completed and final reports on Phase I work have been prepared. In Phase I, the two contractors each fabricated a complete fuel cell/battery power source system (half the size required for the bus) and evaluated the system in the laboratory. The team of Booz, Allen & Hamilton, Chrysler Pentastar Electronics, and Fuji Electric completed the design of a liquid-cooled phosphoric acid fuel cell/battery propulsion system for an urban transit bus; this team then built and tested a 68-kW fuel cell/battery power source system consisting of a 25-kW fuel cell and 43-kW lead-acid battery, a dc chopper to step up the fuel cell output voltage to match that of the battery, and overall system controls. The team of Energy Research Corporation, Los Alamos National Laboratory, and Bus Manufacturing, Inc. completed the design of an air-cooled phosphoric acid fuel cell/battery propulsion system for a bus; this team built and tested a 62-kW power source consisting of a 32-kW fuel cell and 30-kW nickel/cadmium battery, connected in parallel. The test results verified the performance predicted by the design analyses and confirmed the feasibility of the fuel cell bus concept.

Based on the Phase I tests results, the positive recommendations of an ad hoc Advisory Panel, and the findings of an independent study performed for DOT/UMTA, all program sponsors (DOE, DOT/UMTA, and the California South Coast Air Quality Management District (SCAQMD)) have agreed to proceed to Phase II, which is directed at installing a full-size fuel cell/battery propulsion system in an urban bus. Sources are now being sought in a competitive procurement to perform the Phase II system design and integration work.

Question: Will 1991 funding complete the project or will additional funds be needed?

Answer: Additional funding will be needed to complete the project. The annual funding plan for each of the project participants (in thousands of dollars) is as follows:

Participant	FY 1992	FY 1993	FY 1994
DOE	2,500	2,500	1,500
DOT/UMTA	700	800	500
SCAQMD	700	100	100
Total	3,900	3,400	2,100

Question: What is expected to be gained from this program?

Answer: The objective of this program is to develop, evaluate, and show feasibility of a methanol-fueled phosphoric acid fuel cell/battery technology aimed at proof-of-concept of three small urban test-bed buses. One of these buses will be evaluated at DOE and the others will be delivered to DOT/UMTA and South Coast Air Quality Management District. The present cost projections for the purchase and operation of the phosphoric acid fuel cell powered buses using methanol fuel indicate that they would be cost competitive with the diesel engine bus in the mid 1990's at a diesel fuel price of about $1.00 per gallon. The fuel cell powered bus offers advantages in terms of reduced air pollution, quiet operation and the utilization of a non-petroleum based fuel.

Question: Are phosphoric acid fuel cells adequate to commercialize such technology or will high efficiency, more compact technology be required?

Answer: The phosphoric acid fuel cells will be adequate for bus applications, such as inter-city, intra-city, airport car rental shuttles, and on university campuses. For smaller vehicles, such as vans and passenger cars, proton exchange membrane and/or solid oxide fuel cells would be required to meet the specifications for these transportation applications.

Question: What commercial interest is there in this project?

Answer: Interest in this technology is broad, encompassing fuel cell development firms and bus manufacturers. Some 32 requests have been received for the Phase II RFP.

Question: What is the status of licensing DOE developed phosphoric acid technology to foreign firms under this program?

Answer: The Government has rights to a number of relevant fuel cell inventions for most commercial fields of use. Eight U.S. patents are available for license, in accordance with Government-wide patent licensing regulations, 37 CFR 404, in fields of use other than fork-lift trucks. Fuji Electric Corporation has applied for the licensing of this technology for utility and transportation applications. Fuji's request for licensing is under review at the Secretarial level within the Department.

Question: Is this technology critical to fuel cell development?

Answer: The Government has rights to a number of relevant phosphoric acid fuel cell inventions for most commercial fields of use. Eight U.S. patents are available for commercial license. Some of these patents are applicable to the fuel cell/battery powered bus system program. However, licensing of this technology will not hamper the fuel cell development program. Any contractor that wins the competition to integrate a fuel cell/battery power source in a testbed bus will have access to all patents.

Question: Are American companies also interested in the technology?

Answer: International Fuel Cell Corporation (a U.S.-Japanese joint venture) has shown some interest in licensing the phosphoric acid fuel cell technology developed by DOE without a licensing fee. No other American company has shown any interest thus far in licensing this technology.

Question: Is the Department receiving funds to support this program from the South Coast Air Quality Management District in California?

Answer: Yes, South Coast Air Quality Management District is supporting this program.

Question: What is the extent of their commitment?

Answer: SCAQMD provided $600,000 in FY 1990 and according to the current plan will provide $800,000 in FY 1991, $700,000 in FY 1992, $100,000 in FY 1993, and $100,000 in FY 1994.

Question: How long do you expect it to be before actual vehicles using this technology can be built?

Answer: The current project plans calls for the completion of a laboratory evaluation of testbed bus with a proof-of-concept fuel cell battery by March 1993.

Question: Why is no funding provided for this program in 1991?

Answer: The DOE FY 1991 budget request has $2,000,000 to continue the fuel cell/battery bus program.

Question: Could the program be accelerated with additional funds?

Answer: The program is presently on its original schedule and progress is continuing. The current schedule and funding levels are considered adequate and appear to be cost effective. Additional funds are not required.

Question: If so, please specify how and to what extent?

Answer: Additional funds are not necessary to accelerate the program.

Question: What is the estimated cost of the total program?

Answer: The estimated cost for Phase II of the proof-of-concept fuel cell/battery powered bus program is $15,000,000.

Question: What are the advantages of the PEM fuel cell over other technology for tranportation uses?

Answer: All fuel cells, including PEM fuel cells, provide the advantages of reduced emissions, greater energy efficiency, and petroleum independence compared to internal combustion engines. PEM fuel cells offer the potential of significant advantages over the phosphoric acid fuel cell for transportation applications. These include an estimated 25 percent reduction in weight, 40 percent reduction in volume, faster start-up, better transient response, increased reliability, and potentially lower cost. These advantages make the PEM fuel cell potentially suitable for passenger cars and can thereby provide a much larger impact on transportation.

Question: Can solid oxide technologies also be applied to transportation?

Answer: The monolithic solid oxide fuel cell is a technology which has good potential for transportation applications.

Question: Have you investigated applying solid oxide fuel cells to transportation?

Answer: Assessement studies and system modeling have been performed which indicate that the monolithic solid oxide fuel cell is a good candidate for further research and development for transportation applications. A feasibility evaluation effort is planned to be initiated in FY 1991.

Question: How do fuel cells compare to other types of vehicle propulsion in terms of emissions?

Answer: Fuel cells have emission levels which are hundreds of times smaller than internal combustion engines. Test data on phosphoric acid fuel cells indicates that CO emissions are 150 times smaller than internal combustion engines, and emissions of nitrogen oxides and hydrocarbons are over 3,000 times smaller. In addition, fuel cells eliminate the emission of particulates, sulfur oxides, and toxic/carcinogenic compounds.

Question: Is it correct that a fuel cell/battery hybrid vehicle would have the emissions advantages of an electric vehicle without the range limitations of electric vehicles?

Answer: A properly designed fuel cell/battery hybrid vehicle would have the emissions advantage of an electric vehicle without the range limitations.

Question: Please explain what additional work is anticipated in the increase in PEM fuel cell work in energy storage requested in 1991 ($2,000,000 to $5,346,000).

Answer: FY 1991 funds will be used to initiate a major program directed at developing PEM fuel cells as propulsion power sources for road vehicles. A Request for Proposals (RFP) was announced soliciting a system design and integration contractor who would direct a team of industry subcontractors to develop the complete fuel cell propulsion system encompassing the fuel cell/reformer subsystem, peak power battery, electric motor/controls, and transmission. The program is focused on solving the critical system and component problems associated with using the PEM fuel cell for transportation. Over 30 companies responded to the RFP, including the major automobile companies. Also, the California South Coast Air Quality Management District (SCAQMD) considers this to be an important program and has agreed to join DOE in sponsoring this R&D effort. As a result of funding provided by SCAQMD and industry's cost share, DOE's funding ($4,000,000) is well leveraged and will achieve high payback in terms of results achieved. This funding will also support research efforts on optimizing electrode structure and catalyst utilization ($200,000), eliminating parasitic resistances within the cell ($100,000), studying water transport in the cell ($500,000), improving performance on low pressure air and reformed organic fuel and limited life testing ($200,000). Development efforts will be initiated to examine ways of handling impurities in methanol fuel in the methanol steam reformer ($346,000).

Question: What are the areas critical to making the PEM fuel cell transportation program with industry a success?

Answer: The areas critical for making PEM fuel cells successful for transportation are improving the power density of the fuel cell system, providing adequate heat and water management, reducing the system cost through improved catalysts and membranes, developing improved reformer technology to achieve rapid transient response, and improving cell performance on reformed methanol and air by developing CO-tolerant catalysts and/or reformer technology which provides very low concentration of CO in the reformate.

Question: Does this proposed increase accelerate the development of the technology?

Answer: The proposed increase will allow the program to continue on its current and original schedule.

Question: What work is done under this activity with regard to the applicability of the technology to industrial or utility applications?

Answer: The work under this activity is directed toward transportation applications. It has only peripheral application to industrial or utility needs.

Question: Does this work incorporate activity initiated in the ECUT program in 1990?

Answer: The ECUT FY 1990 activity is directed at reducing the noble metal requirements in polymer electrolyte membrane (PEM) fuel cell electrodes. ECUT is funding research at Los Alamos National Laboratory on catalyst dispersion methods. To the extent that the ECUT funded efforts are successful, the PEM technology development team is prepared to incorporate the results into cell testing.

Question: Describe that activity.

Answer: Widespread use of PEM fuel cells in transportation will require the platinum used to catalyze the oxygen reduction reaction to be greatly reduced. ECUT work was planned to study new methods to fabricate carbon-supported platinum electrocatalyst particles less than

2 nm in average diameter by ion exchange technique. A reduction by a factor of 5 below current levels would solve both the cost and availability problems associated with platinum. Use of such small platinum particles could greatly reduce the noble metal requirements in polymer electrolyte membrane (PEM) fuel cell electrodes. Detailed characterization of the supported catalysts using electrochemistry, chemisorption, transmission electron microscopy, x-ray absorption fine structure, and other techniques will be compared with quantum mechanical calculations and Monte Carlo models.

Question: Explain what work was accomplished under the contract with International Fuel Cells (IFC) in PEM fuel cells.

Answer: Effort has been initiated to identify fuel cell requirements for transportation applications. Testing has been started to identify and qualify single-cell performance levels using Los Alamos National Laboratory and IFC technology. The contractor has recently requested a no-cost extension to December 31, 1990.

Question: What are the applications of this work?

Answer: The objective of the International Fuel Cells' program is to develop a 5 kW PEM fuel cell stack for transportation applications. This PEM technology may also be used in small-scale power generators at remote sites.

Question: Is follow-on work expected to be needed?

Answer: No follow-on work is anticipated.

Question: Is it funded in the 1991 request?

Answer: Continuation of the International Fuel Cell (IFC) program is not included in the FY 1991 request. However, a procurement has been initiated to integrate a PEM fuel cell in a testbed vehicle. The objective of this effort is a feasibility evaluation of an electric propulsion system based on a PEM fuel cell and work on the critical problems that must be resolved prior to system scale-up and integration into a vehicle.

Question: What organizations, either industrial, university, or governmental (including national labs) are involved in PEM fuel cell research and in what aspects of research are they involved?

Answer: The following organizations are involved in PEM fuel cell R&D:

U.S. Organizations	R&D Activity	DOE Funding
International Fuel Cells*	Stack development	Yes
Dow Chemical Co.*	Membrane/electrode R&D	No
Argonne National Lab	System analyses and modeling	Yes
Treadwell Corporation	Stack development	No
Ergenics, Inc.	Stack development	No
General Motors Corp.	System development, membrane characterization and modeling	No
Analytic Power, Inc.	Small cells, modeling	No
Giner, Inc.	Membrane - electrode assemblies	Yes
Hamilton - Standard	Integrated regenerative fuel cells Texas A&M University	Yes
Single cell testing, membrane	Yes electrode assembly	
Lawrence Berkeley Lab	Membrane water transport modeling	Yes
Los Alamos National Lab	Catalyst reduction, membrane characterization, water and thermal management and modeling, carbon monoxide tolerance, rapid response reformer for transportation applications.	Yes

Foreign Organizations	R&D Activity	
Ballard, Canada	Stack development	No
Hitachi, Japan	Direct methanol oxidation	No
Siemens, Germany	Stack development	No
DeNora, Italy	Stack development	No
Energy Res. Lab, Denmark	Electrolyte research	No

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* Have ties with foreign companies

Alternative Fuels

Question: How much cleaner than gasoline is methanol?

Answer: Methanol vehicles have potential for emitting 35 percent less reactive hydrocarbons as well as potential for reduced nitrogen oxides emissions. Carbon monoxide emissions are very dependent on engine and air/fuel control and are more specific to particular vehicles rather than fuel. Emissions of aldehydes are expected to be a problem with methanol vehicles and will require special engineering to control them to low levels. Catalyst systems will still be essential elements for emission control of methanol vehicles.

Emissions from methanol-fueled vehicles equipped with a catalytic converter are generally lower than gasoline except for aldehydes. It should be noted that most cars built after 1980 are equipped with an exhaust oxygen sensor to control the air/fuel ratio. This prevents formation of excess carbon monoxide.

Other emission products common to gasoline, such as polynuclear aromatic hydrocarbons, sulfur oxides, soot, etc., are all but eliminated by the combustion of methanol.

Question: Is there some controversy over this question?

Answer: There continues to be uncertainty over this question. Existing data on emissions from methanol vehicles span wide ranges of the regulated emissions; therefore, the data can not be consistently applied in evaluating the environmental impact of methanol use. Methanol vehicles do not yet represent mature technology. So emissions results from methanol vehicles do not necessarily represent lowest attainable emissions nor minimum environmental insult. At the same time, improvements continue to be made in gasoline engines, and petroleum refiners are beginning to "reformulate" gasoline for lower emissions. These factors make comparison of methanol engine technology to gasoline engine technology difficult.

Question: If so, how is it expected to be solved?

Answer: The current automaker/oil company study aimed at comparing methanol emissions with those of reformulated gasoline should help greatly in unraveling the details of the comparison. A further maturing of methanol engine technology that will accompany production of flexible fuel vehicles will also help. One of the problems in interpretation of existing data has been the advocacy issue, where those with a stake in the results have promoted results in their own, most favorable way. This problem can be mitigated by means of objective government programs that address these issues, particularly the Alternative Motor Fuels Act implementation.

Question: Is there uncertainty over whether 85% or 100% methanol fuels are more acceptable.

Answer: There is uncertainty over whether 85 percent or 100 percent methanol fuels are more acceptable, and there are several issues involved.

Question: Is so, please explain.

Answer: While we are confident that M100 has greater potential to reduce ozone forming and toxic emissions than M85 or gasoline, there are other uncertainties associated with the use of M85 or M100. These issues include safety, cold-weather performance, and toxicity. M85 burns with a luminous flame while M100 does not; and the vapors in a closed tank of M100 are combustible while those in an M85 tank are not.

A portion of gasoline also improves the cold-startability of methanol making cold-weather performance more acceptable. (M100 engines have difficulty starting below about 40 degrees Fahrenheit, whereas M85 engines do not encounter difficulty till around 20 degrees Fahrenheit.) Methanol is more toxic than gasoline, but it is more biodegradable when spilled. All of these issues are part of the debate over M85 versus M100.

Question: What are the drawbacks to methanol use?

Answer: A refueling infrastructure does not exist to any extent except at a small number of locations and must be developed before methanol will be used in any meaningful quantities in transportation. Methanol costs more, at least for the present. Driving range for methanol vehicles will be less than gasoline vehicles with comparably-sized fuel tanks. Methanol vehicles will suffer from an immature technology status for some time, whether real or perceived in the eyes of customers. Transporting methanol requires a water sterile system. Methanol in storage tanks may cause deterioration in tank linings or require new storage tanks. The product may be contaminated with small amounts of water typically found in tank bottoms used for storing petroleum liquids. There are also precautions that must be taken to address particular health and safety issues related to the use of methanol. On balance, if these precautions are taken, methanol is a fuel which can be used at public health and safety risk levels that are comparable to those posed by the use of gasoline.

Question: What are you doing about the drawbacks?

Answer: The Alternative Motor Fuels Act of 1988 is intended to address some of these drawbacks by beginning to overcome them at least in limited measure. Some infrastructure will be installed in response to the need to refuel alternative-fueled vehicles purchased by the government, and the technology of flexible-fuel vehicles purchased by the government should represent a more mature technology than that of prototype vehicles in the past. Continued involvement by the government in this demonstration activity will result in industry's involvement in resolving the drawbacks. Industry's incentive will be in their perception of the size of the market share available.

Question: Why is high altitude testing necessary for those fuels.

Answer: Certain types of engines, particularly older light-duty vehicles and most diesel-type engines, operate without oxygen sensors and closed-loop fuel control. As such, their performance and emissions can be influenced by air density, i.e., altitude. Most emission tests are conducted at low altitudes, but some high-altitude areas have air quality problems. The high altitude testing will ensure that the low-emissions potential of alternate fuels is not being compromised by an unexpected influence of air density on the engine operation.

Question: What is being done about cold weather problems?

Answer: Cold-weather start and operations is largely a problem, or set of problems, rightfully addressed by the manufacturers. Cold starting of methanol engines is being addressed by the automakers. Other cold-weather related problems include engine sweat (exacerbated by cold temperatures) and emissions. Cars in the Federal methanol fleet at Argonne National Laboratory are helping to define and identify the problems associated with operating methanol vehicles in cold climates. With this fleet, as well as the others in the Federal methanol fleet, DOE is currently providing data, where possible, to the interested parties in industry. Further data will be generated in demonstrations conducted under the Alternative Motor Fuels Act.

Question: If flexible fueled vehicles are sold, will that make it easier to introduce alternative fuels?

Answer: The introduction of fuel-flexible vehicles will make it easier to introduce alternative fuels because a complete fuel infrastructure will not be needed at the outset. Consumer acceptance and experience with "new" fuels will be established, and manufacturers will obtain operational and maintenance data from on-the-road operations. The development of an alternative fuels infrastructure can follow an orderly and cost-effective process. However, if fuel-flexible vehicles are sold under Clean Air mandates that require them, through Federal or State regulation, to be exclusively refueled with M85 or M100 in non-attainment areas, these advantages would be partially foregone.

Question: Are the major automobile manufacturers going to do this?

Answer: The major automakers are going to sell flexible-fuel vehicles, first to governments in modest numbers, then to the public. Both California and DOE plan to purchase flexible-fuel vehicles numbering in the thousands, and automakers are responding to those plans. Furthermore, it is expected that automakers will offer flexible-fuel vehicles to the public in the mid-to-late 1990s in response to the CAFE credits available through the Alternative Motor Fuels Act of 1988.

Question: When?

Answer: California in 1990, 1991, and 1992; U.S. Federal Government in 1991, 1992, and 1993; and the public in the mid-to-late 1990s.

Question: Where?

Answer: California first, then the rest of the Nation with emphasis on areas with significant air quality problems.

Question: Are these vehicles expected to be more expensive than regular vehicles?

Answer: Flexible-fuel vehicles may cost slightly more than today's vehicles, but the price is not expected to be either a deterrent or incentive.

Question: By how much?

Answer: Estimates of the difference vary greatly from no difference to about $1,000 greater. Most estimates are about $300 to $600 more for the flexible-fuel feature in production vehicles.

Question: Will they be more or less efficient?

Answer: On an energy basis, flexible-fuel vehicles will be at least as efficient and possibly up to 5 percent more efficient than today's gasoline vehicles. On a per gallon basis, they will use more fuel when running on methanol or ethanol because of the lower energy density of these fuels.

Question: How much cleaner will they be than gasoline powered vehicles?

Answer: If a flexible-fueled vehicle is operated on M85, it has the potential of producing approximately 30 percent less reactive emissions of ozone-forming organic compounds and a similar reduction of toxic emissions. The actual emissions performance of these vehicles can vary depending on how their performance is optimized vis a vis gasoline-fueled operation versus M85-fueled operation. When operating on gasoline, the emission characteristics of flexible-fueled vehicles should be similar to a comparable gasoline-fueled vehicle. We will be collecting substantial test data on these types of vehicles, and will revise our estimates as these data become available.

Question: What is the cost of methanol versus gasoline?

Answer: As shown in the table below, the price of methanol is dependent on a number of factors, most notably the level of technology used to produce methanol and the price of natural gas. The estimates shown assume that natural gas would cost $1.10 per million cubic feet, a price that may be typical of gas resources in many countries with substantial gas resources in relationship to internal demand. This table provides cost estimates based on current and advanced technology plants and estimated shipping and distribution costs. These price estimates assume a normal return to the investor, a condition which is often not satisfied in volatile markets, such as the market for methanol. Therefore, even assuming the accuracy of these estimates, actual prices may vary considerably.

Estimated Methanol Prices

Methanol Plant Technology	Current	Advanced
Capital recovery	$0.21	$0.12
Operating costs		
natural gas*	$0.11	$0.10
other	$0.10	$0.06
Plant gate cost	$0.42	$0.28
Shipping cost	$0.06	$0.06
Mark-up (M100)	$0.26	$0.26
M100 price, per gallon	$0.74	$0.60
M85 price, per gallon	$0.80	$0.68

Gasoline Equivalent Prices

Methanol Plant Technology	Current		Advanced	
Vehicle efficiency improvement	None	6%	None	6%
M100	$1.48	$1.39	$1.20	$1.13
M85	$1.38	$1.30	$1.18	$1.11

*Natural gas is assumed to cost $1.10/mcf.
The retail price of gasoline is assumed to be $1.10.

Question: If methanol is produced in large quantities, from where will supplies come?

Answer: If methanol production capacity were to expand substantially, it is likely that this expansion will be based on gas derived methanol production capacity built in countries outside of the United States. The table below provides a list of potential low cost suppliers of methanol.

Areas with Prospectively Low-Cost Natural Gas Reserves
(Proven Reserves - TCF)
(Year End - 1988)

OECD	
Alaska	9
Canadian Arctic	56
Norwegian	19
Australia	17
New Zealand	5

PERSIAN GULF OPEC	
Iran	492
Saudi Arabia	152
Kuwait	49
U.A.E.	202
Qatar	157
OTHER OPEC	
Indonesia	84
Algeria	104
Libya	26
Nigeria	85
Venezuela	102
Ecuador	4
NON-OPEC, NON-OECD	
China	32
Thailand	4
Malaysia	52
Mexico	75
Trinidad, Tobago	10
Argentina	27
Chile	4
Soviet Union	1500
WORLD RESERVES	3936

Sources:

U.S. Department of Energy, Energy Information Administration, International Oil and Gas Exploration and Development Activities, Quarterly Report, First Quarter 1989.

U.S. Department of Energy, Energy Information Administration, U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves: 1988 Annual Report, September 1989.

It is possible that methanol may be produced from other feedstocks than natural gas, such as coal or biomass. This would result if worldwide natural gas prices increased significantly, and/or if the cost of coal or biomass produced methanol were reduced from current estimated levels. DOE's methanol related research should result in reduced cost for both coal and biomass methanol production technologies.

Question: Will prices increase because of new demand?

Answer: Methanol prices could increase if increased demand outstripped the expansion of methanol supply. Also, it is possible that more methanol capacity could be built than increased demand would support, except at reduced prices. The methanol market has been characterized by volatile prices, and this volatility could continue into the future.

In the long run, methanol prices may fall as advanced technology plants are built. However, if world natural gas prices increase, these advances in production technology could be offset by higher feedstock prices.

Question: What incentives are there, if any, for anyone to buy a flexible-fueled vehicle or use methanol?

Answer: A flexible-fuel vehicle will usually have better performance (power) when operating on methanol than a comparable gasoline vehicle. The performance difference can be substantial for some engine designs. In limited instances, perhaps, the sense of helping air quality or energy security might find appeal.

Question: Please explain what additional work in alcohol fuels you would do for the $2,420,000 increase proposed in 1991.

Answer: The additional funding is intended for research and technology development of new concepts to improve the emissions and fuel economy of alcohols and natural gas engines, and to develop better emission data on various alternative fuels. The technology concepts include oxygen enrichment to enhance combustion and improve exhaust catalyst performance with alcohols and natural gas where emissions of unburned fuel and formaldehyde remain a concern. Catalysts specifically for alternative fuels, either with new materials or new configurations, need to be developed and evaluated. Other approaches to improving alcohol and natural gas engine technology involve the application of new in-cylinder materials or advanced combustion systems. The emissions data will provide an atmospheric chemistry profile of each fuel tested, and will provide better input to pollution models.

Question: Is this work coordinated with industry?

Answer: DOE and its lead alternative fuel laboratories have frequent visits to and discussions with industry to make sure projects are focused on important issues and are not duplicative.

Question: If so, how?

Answer: DOE and DOE laboratories routinely are in contact with automobile, engine, and energy companies to obtain feedback on new efforts. In many cases, workshops are conducted for this purpose and such a workshop is being planned to discuss improved natural gas and alcohol engine technologies. In addition, a catalyst manufacturer is already working with the DOE methanol fleet at Oak Ridge National Laboratory to evaluate a new catalyst configuration. Discussions on the entire subject of enhanced combustion technologies for alternative fuels were held during a series of visits to industry during FY 1989 and early FY 1990.

Question: Will catalytic converters be needed with alcohol fuels?

Answer: The use of alcohol fuels, without other major engine technology advances, will not eliminate the need for catalytic converters. In fact, heavy duty (truck and bus) engines that now do not utilize catalytic converters may eventually need them to meet new emission standards with alcohol fuels. For light-duty vehicles, additional catalyst development may be required to further reduce the increased aldehyde emissions from methanol use especially in light of possible future State and Federal regulations.

Question: Why?

Answer: The state-of-the-art in spark-ignition engine and combustion technology is not adequate to meet emissions standards without exhaust catalyst aftertreatment for essentially any carbon-containing fuel.

Question: What work is being done on such catalysts?

Answer: Many automotive manufacturers are studying exhaust catalysts for alcohol fuels. EPA is evaluating emissions control performance of numerous alcohol vehicles with catalytic exhaust aftertreatment, as is the State of California. The DOE Federal methanol fleet is providing data as well, and two vehicles at Oak Ridge National Laboratory are serving as testbeds for a prototype catalyst configuration in collaboration with a manufacturer. In addition DOE plans to initiate a modest catalyst investigation program in FY 1991.

Question: Will catalytic converters be used in flexible-fueled vehicles?

Answer: Flexible-fuel vehicles utilize spark-ignited engines with emissions control methods that require exhaust catalysts.

Question: Is the technology available to do that?

Answer: Conventional catalytic materials may be adequate. The size, location and configuration of the catalytic converters may need to be re-engineered to achieve the desired performance with flexible-fuel vehicles. The long-term performance of the catalyst remains somewhat in question.

Question: Explain why ethanol is, or is not, a reasonable fuel for vehicles.

Answer: The advantages and constraints to the use of ethanol as a transportation fuel (either "neat" or in blends) are mixed. Ethanol as a neat or blend stock has the potential for vehicle utilization with no increase in net carbon dioxide emission. In optimized engines, neat ethanol as a high octane fuel can provide improved vehicle performances and better thermal efficiency. Ethanol produced from biomass is a renewable fuel and as such has economic and national security implications. Ethanol can be produced from both food and non-food crops. Neat ethanol combustion produces a more visible flame than methanol. Up to 10 percent ethanol can be blended with gasoline and used with no vehicle modifications. Essentially none of the automotive manufacturers discourage the use of 10 percent ethanol blended with gasoline in the operators' manual. Ethanol has many of the characteristics of methanol and as such can be used interchangeably with methanol for many applications.

The principal detriment in transporting ethanol or ethanol blends by pipeline today (while the volumes being moved are quite small) involves the bother of keeping those fuel products separate from water other petroleum products. The use of alcohols (either methanol or ethanol) in existing storage tanks include deterioration of tank linings and contamination with the small amount of water that typically is present at the bottoms of tanks used in storing petroleum liquids (mixing with water can cause separation of the alcohol with the blends). A gallon of ethanol contains about two-thirds the energy of a gallon of gasoline. Thus to travel the same distance between refuelings, a 50 percent larger vehicle fuel tank would be required. Use of neat ethanol (like neat methanol), however, requires hardware changes to achieve optimal operation (e.g., engine compression ratio) and changes to the fuel system. Large-scale utilization in the United States will be limited by the availability of raw materials, although the use of cellulosic feedstocks could make the future supply of ethanol in large amounts more reliable.

Question: Is ethanol more costly than other alternatives if tax subsidies are removed?

Answer: Currently, U.S. ethanol prices (at the plant gate) are approximately $1.10 to $1.25 per gallon, equivalent to about $13.00 to $15.00 per million Btu. These prices exclude the benefit of the Federal tax credit of $0.60 per gallon for U.S.-produced ethanol derived from agricultural products and other State financial incentives. In comparison, methanol prices have historically ranged between $0.40 and $0.50 per gallon ($6.20 and $7.80 per million Btu), mid-grade gasoline costs $0.70 per gallon at the refinery gate, and natural gas costs $3.00 to $3.50 per thousand cubic feet ($3.00 to $3.50 per million Btu). Thus, on an energy equivalent basis, non-subsidized ethanol costs are significantly higher than methanol and natural gas.

It should be noted that the figures above do not account for improvements in the thermal efficiency possible with neat ethanol use (compared to gasoline) and also exclude distribution and transportation costs.

DOE has ongoing research that is focused on providing improved technology (i.e., cellulose-based processes) and inexpensive feedstocks (i.e., trees and waste paper) for the production of ethanol. Whether the long-term future cost of ethanol using these technologies and raw materials will be less than other alternative fuels is not known.

Question: Are processes for producing ethanol energy efficient?

Answer: Today's state-of-the-art ethanol facilities are energy efficient, requiring only 40 to 50 thousand Btu's to produce one gallon of ethanol, which contains 76,000 Btu's. The Department is currently engaged in an ethanol initiative to conduct R&D on the conversion of cellulosic materials (wood, energy crop, municipal solid waste, forestry and agricultural wastes) to ethanol. One of the goals of this program is to cut the energy requirements by 25 to 50 percent.

Question: What knowledge do you have of oil and automotive industry plans to test low emission gasoline and other fuels?

Answer: Currently three U.S. domestic automotive manufacturers and 14 oil companies are pursuing an extensive joint research and testing program to evaluate a wide range of reformulated gasolines. The objective is to pinpoint the effects of fuel composition on emissions, especially as they relate to ground-level ozone formation.

The research program has two phases. The first phase involves examination of the emissions, air quality effects, and cost/benefit relationships of methanol fuels used in prototype vehicles, and of reformulated gasolines used in a representation of current vehicle population. This initial phase is scheduled for completion by mid-1990. The second phase of the program is currently under development with a projected start early next year. This program will use information from the initial phase to conduct research on advanced technology alternative fuel and gasoline-powered vehicles as well as other alternative fuels such as compressed natural gas.

Question: Are you involved in any way?

Answer: DOE has maintained a continuing dialogue with the petroleum and automotive industry regarding the comprehensive testing program now underway for reformulated fuels. The strategy and protocol for the tests were submitted to DOE for our comments, and the results will be made available to DOE for inclusion in our database. In addition, the American Petroleum Institute (API) has agreed to make available quantities of the "best" reformulated fuels resulting from the tests to be used by DOE as a comparison fuel in the demonstration activities to be conducted under the Alternative Motor Fuels Act.

We have also been informed that API and industry representatives have formed a special committee to formulate a cooperative technology development and evaluation program which will be presented to DOE for our consideration in the near future. It is expected that the program will include utilization of our combustion research capabilities and integration of reformulated fuels in our alternative fuel demonstration projects.

Question: Are reformulated gasolines expected to be a reasonable approach to reducing emissions?

Answer: Depending on how they are reformulated, such fuels could be a reasonable emission control option for the near future, providing environmental benefit without great costs to industry. Reformulated gasolines should be compatible with current engine designs and with the current gasoline distribution system since their compositions are fairly similar to current conventional gasolines.

Question: How much do existing reformulated fuels from ARCO and Shell decrease emissions?

Answer: Without test data, we are unable to predict how much emissions will decrease with the Shell reformulated gasoline. Results from exhaust emission tests utilizing the ARCO EC-1 reformulated gasoline showed reductions of about 5 percent in hydrocarbons and oxides of nitrogen and approximately 10 percent in carbon monoxide. These tests were conducted with older vehicles designed for operation with leaded fuel.

Question: Can they be used by all cars or are they limited?

Answer: The overall compositions of reformulated gasolines are very similar to the conventional gasolines they displace. Consequently, most cars should be capable of using reformulated gasolines without problems. A few potential problems may occur in older vehicles due to the use of some oxygenated additives in reformulated gasolines. However, in general, no changes to vehicle fuel systems should be expected with the use of reformulated gasolines.

Question: Are they more expensive?

Answer: DOE estimates that reformulated gasoline is likely to be 8 to 16 cents per gallon more expensive than conventional gasoline. This estimate includes the effect of reduced fuel economy caused by the addition of oxygenates to restore the loss of octane caused by the removal of aromatics from gasoline. However, this does not necessarily mean that the price of reformulated gasoline would increase by 8 to 16 cents per gallon since refiners will price their products to be competitive in the marketplace.

Question: What problems are there with aromatics in gasoline?

Answer: Aromatics are used principally to increase the octane quality of fuels. Principal aromatic fuel components are benzene, toluene, and xylene. Benzene can pose health problems because it is a known carcinogen; however, the benzene content of fuels is low, usually less than two percent by volume. Toluene and xylene are the major aromatic fuel components. The aromatics as a hydrocarbon class typically have higher photochemical reactivity (smog-forming potential) than many other fuel components.

Question: Will pending Clean Air legislation mandate reductions?

Answer: As currently written, the Senate version of the Clean Air Act (S. 1630) incorporates provisions to reduce the aromatic content in gasoline beginning in 1992. According to these provisions, only specific levels of aromatics (by volume) would be allowed in gasoline. On the House side, an amendment to the House version of the Clean Air Act Amendments (H.R. 3030) would limit aromatic content in gasoline to a specific level beginning in 1995.

Question: What is the percentage of aromatics now compared to historical levels?

Answer: Current gasolines typically have significantly higher aromatic content than gasolines of ten or fifteen years ago due to their high octane properties. Prior to lead phaseout in the early 1970s, gasolines averaged about 10 to 15 percent aromatics. Currently petroleum refiners rely more extensively on use of aromatics in gasoline to replace octane lost from lead removal. Current gasolines average up to 35 percent aromatics. Refineries do have other, possibly more costly, options for high octane components; however, aromatics production and blending effects for octane control are the historical methods.

Question: Would reformulated gasoline, for example, have more or less aromatics than regular gasoline?

Answer: There is no single composition of conventional gasoline in today's market. Each refiner establishes its own composition of gasoline to meet market demand, in accordance with a rigid set of fuel performance specifications set by the American Society for Testing and Materials (ASTM). Similarly, there is no one definition or composition for reformulated gasoline. The reformulated gasolines produced to date have had widely varying compositions, yet all meet (or intend to meet) the same ASTM specifications.

Comparisons of reformulated gasolines with an "average" conventional gasoline would not be feasible because of the wide variances in composition of the reformulated gasolines.

Question: Is there money in the budget in addition to that specifically indicated for implementation of the Act?

Answer: There is money in the budget in addition to that specifically designated in the Act.

Question: If so, please describe the work and the amounts.

Answer: Since 1976, DOE has had an Alternative Fuels Utilization Program (AFUP) with a heavy emphasis on technology transfer. Industry has participated extensively throughout various elements of AFUP-sponsored research, development, and evaluation projects. Examples of current activities conducted as part of AFUP which are supportive of and contribute to the technologies expected to be evaluated under the AMFA program, are as follows:

- Design, establishment, and operation of a national alternative fuels data center. The center will be responsible for collection and analysis of all available data on alternative fuels utilization (including fuels, emissions, and performance data); the design and operation of a computerized system for storage, retrieval (including a simple methodology for "outside" users in the scientific, industrial, and government communities to extract data), organization into compatible segments that provide auxiliary information (quality, operational aspects, time, location, etc), and updating and purging; the establishment and dissemination of a uniform data collection protocol for future tests and demonstrations; and the publication of reliable, accurate reports and summaries. ($600,000)

- Quantification of emissions profiles on alternative-fueled engines. Engine tests will be conducted on various alternative fueled-engines and the combustion products containing carbon identified in detail. Results of these tests will be used for confirmation studies on decomposition mechanisms and rates of selected species. Species of interest include formaldehyde, higher aldehydes, methane, MTBE, ETBE, and other partial oxidation components. ($500,000)

- Model inputs for high altitude emissions. Conduct high altitude compression engine emissions tests with alternative and standard fuels to determine the emissions penalty for high altitude operations. Data generated will be used to enhance the quality of existing models. ($100,000)

- Alternative fuels atmospheric models. Integrate global greenhouse gases data from alternative-fuels engine utilization and fuels production methods to determine contributions and model inputs. ($300,000)

- Federal and Hawaii methanol fleets. The continued operation of the Federal and Hawaii methanol fleets will contribute data and inputs relevant to the data acquired under the Act. ($500,000)

Question: How much of the direct funding is for the West Virginia University testing program?

Answer: Of the direct funding, $1.2 million has been allocated for the West Virginia University (WVU) vehicle/engine testing program.

Question: What is the status of this work?

Answer: West Virginia University is in the process of developing the hardware requirements for the testing equipment. The schedule calls for completion of the transportable vehicle dynamometer emission test modules by the end of 1990.

Question: How is the high altitude testing at Colorado different than the WVU work?

Answer: The Colorado School of Mines facility will have the ability to perform engine/vehicle testing at high altitude at a fixed equipment laboratory. The WVU chassis dynamometer is being designed in a mobile configuration so that it can be transported to various vehicle test sites.

Question: What specific funding is included for Colorado state for high altitude testing?

Answer: Under the capital equipment budget request, $500,000 is requested to complete the emissions test facility being established by the Colorado School of Mines in cooperation with the Regional Transportation District, the Public Service Company, and the State of Colorado. Depending on the number of tests conducted at the facility, another $100,000 to $200,000 could be spent on actual vehicle or engine tests.

Question: Is all of this funding in support of the Act?

Answer: Although the funding is not included as part of the Act implementation request, all of the funding does indirectly support the Act and will be used to provide the capability to generate data to complete the emission database.

Question: If not, what else is it for?

Answer: The facility will also be used to provide input and data for atmospheric modeling work for alternative fuels utilization.

Question: What is the status of the light duty vehicle demonstration program?

Answer: An interagency agreement has been negotiated with the General Services Administration (GSA) that will allow for the procurement of light duty vehicles by GSA and the placement of these vehicles in the Federal fleet. A draft procurement solicitation has been developed by GSA, and it is expected that initial procurement of vehicles can be accomplished by the beginning of calendar year 1991. Several meetings have been held with representatives of the automobile industry to determine the availability and timing of the necessary vehicles. In addition, a review is underway to determine the nationwide locations of available refueling stations and to identify those Federal agencies interested in using these vehicles. Work is also underway to develop a data system that will provide for the collection and analyses of data elements as part of the design, establishment, and operation of a national alternative fuels data center.

Question: What locations are likely to receive vehicles, how many, what agencies, when, etc.?

Answer: The light-duty vehicles will be placed primarily in locations that represent the most severe non-attainment urban sites in the country. Considerations are also being made to include sites that fulfill needs for climate and altitude variations, access to refueling locations, and availability of emission test facilities.

Identification of Federal agencies that are interested in using these vehicles is underway. Criteria are being developed to help guide this selection process such as degree of agency interest, typical mileage accumulation rates, and ability to accommodate the data collection process without impeding the quality of the data or the mission of the agency.

The Federal light duty vehicle acquisition effort is expected to add 100 to 200 alternative fueled vehicles per year the first year, and increase to 1,000 to 2,000 per year as additional fuel/vehicle combinations become available. It is expected that initial procurement of vehicles can be accomplished by the beginning of calendar year 1991.

Question: If major automobile manufacturers are going to produce flexible-fueled vehicles, why do you need to demonstrate alcohol fueled vehicles separately at all?

Answer: Flexible-fueled vehicles by design do not necessarily take advantage of the full potential that each of the individual fuels has to offer. The demonstration of "neat" alcohol-fueled vehicles offers the opportunity to assist industry in developing vehicles that would optimize the maximum benefits these vehicles may offer.

Question: How much of the program involves natural gas vehicles?

Answer: At this time, there is no indication that natural gas vehicles, either flexible fueled or dedicated, are being considered by the major automotive manufacturers for production in the near term. However, R&D is being conducted on dedicated light duty natural gas vehicles and they may become available within a year or two. It is expected that these vehicles, as well as natural gas dual-energy vehicles, will be procured in sufficient numbers to meet the intent of the legislation as they become available.

Question: What activity are you undertaking in the heavy duty vehicle program?

Answer: Numerous discussions and site visits have been held with the major heavy duty engine manufacturers to coordinate planned evaluation, demonstration, and testing programs. Discussions have also been held with representatives of groups representing the natural gas, methanol, and ethanol industries to solicit their participation in the conduct of these demonstrations as well as to solicit their assistance in the areas of fuel supply and refueling facilities. It is anticipated that activities will in part be coordinated with State agencies such as the California Energy Commission and the New York State Energy Research and Development Authority, which are operating their own heavy duty engine alternative fuel programs. This will help assure compatibility of data acquired and maximize the cost-effectiveness of available funds. This program will also be an integral component of the design, establishment, and operation of a national alternative fuels data center.

Question: Do you actually pay for demonstration vehicles?

Answer: Typically, alternative heavy duty fueled engines are acquired, either by purchase or lease, from the engine manufacturers and placed in vehicles owned and operated by fleet operators with DOE funding incremental costs for engines and data collection. DOE will not own the heavy duty engines or vehicles. Industry has indicated a willingness to cost share testing and data collection efforts. Although the collection and analysis of data will be managed and carried out by DOE to insure data reliability and compatibility, industry will be integrally involved in the performance and service data efforts. Engine manufacturers can be expected to contribute in-kind cost sharing for monitoring engine performance and component failures and safety-related issues. They will also normally staff on-site equipment support personnel to monitor demonstration activities and provide technical inputs. Commercial trucking fleets also have indicated a willingness to absorb some elements of additional operating costs from the evaluation and demonstration activities. Light duty automobiles will be procured directly by GSA for use in the Federal fleets with DOE funding the incremental costs compared to gasoline-fueled vehicles.

Question: What demonstration vehicles or fleets exist?

Answer: No heavy duty vehicle fleets have been established to date. However, several States are operating or planning their own alternative fuel heavy duty vehicle programs. For example, the California Energy Commission has a program involving up to 14 methanol fueled vehicles. The vehicles include dump trucks, refuse packers, sludge haulers, delivery trucks and semi-trailers. Participating engine manufacturers include Detroit Diesel Corporation, Caterpillar, Navistar, Ford, and Cummins. The New York State Energy Research and Development Authority is also developing a heavy duty demonstration program. Discussions are underway with these State agencies, the American Trucking Association, and the natural gas associations to both initiate new projects and join existing projects by the end of 1990.

Question: Where and in what size and amounts?

Answer: As indicated above, no heavy-duty vehicle fleets have been established to date under the Alternative Motor Fuels Act. Initial locations are likely to be limited to areas where refueling facilities are available. Plans are being made to place about 5 to 10 heavy duty trucks in fleet demonstrations beginning in late FY 1990 or early FY 1991.

Question: What is the extent of the bus demonstration program?

Answer: An interagency agreement has been negotiated and signed with the Urban Mass Transportation Administration (UMTA) for the purpose of testing buses using alternative fuels in urban settings. Under an UMTA Alternative Fuels Initiative Program, there are expected to be approximately 300 transit buses at 50 locations that will be using alternative fuels. These vehicles provide the opportunity to collect and analyze data on durability, safety, and fuel economy as required by the Alternative Motor Fuels Act. DOE's main role in this program element is to provide specific details on testing requirements and data collection procedures and provide emissions testing capabilities and operations. Currently, a workshop is being planned to assist in identifying critical data needs. In addition, test protocols are also being developed and will be refined via the workshop results.

Question: What is your role in it?

Answer: DOE will provide guidance and specifications, as well as funding, for the data generation, acquisition, and analysis protocols, techniques, and procedures, including the installation and operation of data acquisition systems, to generate and acquire the data required by the Alternative Motor Fuels Act. DOE will also be responsible for the collection of available emissions data. This effort will become an integral component of the design, establishment, and operation of a national alternative fuels data center.

Question: Please explain what the Interagency Commission on Alternative Fuels and the United States Alternative Fuels Council do.

Answer: The Interagency Commission on Alternative Fuels is charged with a number of functions:

- Coordinating Federal agency efforts to develop and implement a national alternative motor fuels policy
- Ensuring the development of a long-term plan for the commercialization of alcohols, natural gas, and other potential alternative motor fuels
- Ensuring communication among representatives of all Federal agencies that are involved in alternative motor fuels projects or that have an interest in such projects
- Providing for the exchange of information among persons working with, or interested in working with, the commercialization of alternative motor fuels.

As directed by the Alternative Motor Fuels Act, The United States Alternative Fuels Council has been established by the Chairman of the Interagency Commission on Alternative Fuels to report to the Commission about matters related to alternative motor fuels.

Question: What is your assessment of what useful information or data the government will get out of activities related to the Alternative Motor Fuels Act (be specific)?

Answer: The Administration, Congressional, public, and industrial interest in the utilization of alternative motor fuels has increased dramatically in the last couple of years. This increased interest has been driven mainly by environmental and fuel-supply security considerations. In particular, this has been very apparent in the deliberations over amendments to the Clean Air Act. In implementing provisions of any new Clean Air Act amendments and in a multitude of future actions to be taken by both industry and government, far-reaching decisions will be necessary, and these decisions should be made on a foundation of accurate, reliable, unbiased, and compatible data on the most current and emerging vehicle systems technology.

One of the most significant problems that has emerged for the effective development of alternative fuel options is the availability of reliable, compatible data. This has been due to a variety of technical reasons and the diverse objectives of both public and private research organizations. Therefore, there is a widely perceived need for a national alternative motor fuels data center that would be responsible for:

- the collection and analysis of all available data on alternative fuels utilization, including both fuels and performance data
- the design and operation of a system for storing, retrieving, organizing, and updating data related to the latest vehicle systems technology
- the establishment and dissemination of a uniform data collection protocol for tests and demonstrations
- the publication and dissemination of reliable, accurate reports and data summaries.

The Alternative Motor Fuels Act (AMFA) and DOE's long-term history in assisting the development of alternative fuels technologies provide a unique opportunity to serve as the foundation for the establishment of such a data center. In addition to the wide variety of data that will be collected under the controlled and specified conditions of the Federal light-duty, commercial heavy-duty, and bus demonstrations required by the provisions of AMFA, such a center would be unbiased (i.e., not affiliated with industry or a regulatory agency), while having direct ties to the latest technology base of both the fuels and vehicle/engine industries as well as other Federal and non-Federal alternative fuels programs.

Advanced Ceramic Materials

Question: Since last year, what additional progress has been made in developing industrial capability in high temperature materials?

Answer: The past year has seen expansion and scale up of pilot plant facilities for advanced ceramics. At least one new production plant for advanced structural ceramics (automotive valve train parts) was built and is being run initially as a pilot facility. Steady progress is being made in joint venture companies; for example, new bearing materials and applications have been developed. Zirconia and zirconia-toughened alumina (materials developed in the Advanced Materials Development Program) have been scaled up and a production plant built. New ceramic compositions for automotive gas turbine applications have been developed and tested.

Question: Have there been additional products introduced since last year?

Answer: A number of new products have been introduced in the past year. Details are proprietary to the ceramic companies and their customers. New ceramic bearing materials and applications have been developed; for example, for use in submarines. New applications in industrial cutting and wear have been introduced. New materials for use in manufacturing silicon devices were introduced. New abrasives for precision grinding were introduced. Ceramic valves and valve train parts are in the late pilot stage are being tested by numerous customers, but are not yet commercial. New ceramic automotive water pump seals for German automobiles were introduced. Many of these new products are spinoffs from technology developed in the Advanced Materials Development Program.

Question: What are the near and mid-term markets for ceramic products?

Answer: Near-term applications include ceramic bearings for machine tools, gyroscopes, jet engines, etc., wear products for industrial knives (can dies, slitter knives. etc.), dies, cutting tools, automotive water pumps, other pump seals, industrial valve trim, and abrasives for precision grinding.

Mid-term applications include automotive valves and valve train components, ceramic gas turbine engine components, ceramic components for auxillary power units in aircraft and gas turbine engines for military applications.

Question: Materials and processing work decreases in 1991. (p.368). Shouldn't this be an area of emphasis?

Answer: Materials and processing is, of course, critically important. The decrease in materials and processing, and corresponding increase in database and life prediction in FY 1991 is due to the natural progression from material development to material characterization and database development in our program. New materials are first developed, then characterized with respect to mechanical behavior, and a database established. The Ceramic Technology for Advanced Heat Engines Project is a planned 10-year program, which is scheduled for completion in 1993. As the project approaches completion, we will continue to complete material development tasks and progress the new materials into the database and life prediction segments of the project.

Question: What is industrial involvement in this work?

Answer: Industry is expected to participate in about 20 contracts and cooperative agreements in the Materials and Processing activity in FY 1991. Of the $7.5 million in FY 1991 funds for Materials and Processing, about $5.4 million will be passed on to industry. In recent years, industry has provided an average of about 25 percent cost sharing in their advanced materials contracts.

Question: What is the dollar value of the Oak Ridge work?

Answer: In FY 1991 the ORNL participation in materials and processing will account for $1,425,000 (19 percent). The ORNL work closely parallels the industry work. The ORNL scientists serve as the contract monitors for the industry contracts.

Question: What was it in 1990?

Answer: In 1990, industry is participating in 20 contracts and cooperative agreements in the Materials and Processing area. Of the $9.4 million in FY 1990 funds for Materials and Processing, $7.0 million is going to industry contracts and cooperative agreements.

Question: Is there less industrial involvement projected in the materials and processing area compared to last year's budget?

Answer: There is slightly less industry involvement (72 percent of funds contracted out in FY 1991, compared to 75 percent of the funds contracted out in FY 1990). This is primarily due to the successful completion in FY 1990 of two industry programs in whisker-toughened silicon nitride.

Question: In addition to the direct work in advanced materials, what other ceramics work is being undertaken by conservation in 1990 and 1991 and in what budget areas?

Answer: In addition to the direct work in advanced materials, other ceramics work by conservation being undertaken in 1990 and 1991 is as follows:

	(dollars in millions) FY 1990	 FY 1991
Transportation Technologies		
- Advanced Turbine Technology (ATTAP) (Ceramic Components)	11.868	7.4
- Heavy Duty Transport (Ceramic Coatings)	4.925	4.0
- Multi-sector Tribology (Ceramic Friction and Wear)	0.963	1.06
Building Technologies		
- Building Equipment (Ceramic Gears for Solution Pumps)	0.2	0.2
Industrial Technologies		
- Continuous Fiber Ceramic Composites	0.5	0.0
- High Pressure Heat Exchangers	0.9	0.9
- Ceramic Components for Stationary Turbines	0.7	0.7
- Sodium Heat Engine Beta-Alumina	0.4	0.3
- Multi-sector Materials (Processing/	2.8	2.5

Question: How is this work coordinated to avoid duplication and share information?

Answer: Inter-office coordination on this work is accomplished informally through discussions among the responsible DOE/CE program managers. Formal Conservation and DOE-wide coordination is accomplished through formal presentation/coordination quarterly meetings of the Energy Materials Coordinating Committee (EMaCC). Interagency coordination is accomplished formally through the Office of Science and Technology Policy (OSTP) Committee on Materials (COMAT) which meets periodically to discuss all materials issues, including ceramics, and the Interagency Coordinating Committee on Structural Ceramics which meets annually.

Question: What other work related to ceramics is done in the Department?

Answer: Other DOE advanced ceramics programs are in the Office of Industrial Technology for waste heat recovery and ECUT materials, the Energy Research Office of Basic Energy Sciences, and the Fossil Energy Office of Technical Coordination. A table of funding for structural ceramics R&D at the DOE follows:

	($ in millions) FY 1990 Actual	 FY 1991 Request
Conservation and Renewable Energy		
Office of Transportation Technologies		
- Advanced Materials Development	14.636	14.0
- High Temp. Materials Lab.	2.275	2.8
- Capital Equipment	1.417	.5
- Advanced Turbine Technology	11.868	7.4
- Heavy Duty Transport	4.925	4.0
Office of Industrial Technologies		
- Waste Energy Reduction	2.5	1.9
- Multi-sector Materials	2.8	2.5
Energy Research		
Office of Basic Energy Sciences		
- Div. of Material Sciences	6.5	6.5
Fossil Energy		
Office of Technical Coordination		
- Advanced Research & Tech. Development	1.4	1.6

Question: How is that coordinated with your work?

Answer: There is good inter-office coordination of these efforts between the responsible DOE program managers. Program and project information is shared through the DOE Energy Materials Coordinating Committee (EMaCC) and the Interagency Coordinating Committee on Structural Ceramics.

Question: Is there any organized program to apply advanced ceramics in the near term to automotive or stationary engines?

Answer: There are organized programs at all the major automobile and heavy-duty engine companies. Advanced ceramics have now been tried, and in several instances commercialized, in many near-term applications by these companies. The applications proved in service include: ceramic valve train components, cam rollers, turbocharger rotors, diesel piston and liner insulation, exhaust port liners, ceramic bearings, and corrosion protection coatings. Advantages found were many, including: improved fuel economy, reduced exhaust emissions, reduced friction and wear, reduced weight and inertia, and improved fuel tolerance. While in the past ceramic components often failed when run in engines, the situation now is that ceramics generally have acceptable reliability and durability for these applications. According to industry, the limiting factor now is that ceramics cost too much in comparison to the materials they might replace, even though using ceramics would result in significant advantages.

We see this situation changing as the automobile and heavy-duty engine companies respond to environmental and fuel economy legislation. Diesel companies are developing ceramic components to meet legislated particulate and nitrogen oxides emission requirements for 1992 and 1994. The Alternative Motor Fuels Act of 1988 will result in further ceramic usage. And for the automobile industry, when the uncertainties about the provisions contained in the Clean Air Act and any new Corporate Average Fuel Economy (CAFE) legislation are settled, ceramics will be applied much more in new production engines.

Question: Does this require a different research orientation and different programs than your regular advanced materials work?

Answer: The Advanced Materials Development Program has focused on the long-term goals of developing an industrial technology base for high temperature, high performance ceramics applicable to advanced heat engines (i.e., the ceramic-based automotive gas turbine and the low-heat-rejection diesel engine). Cost reduction has not been a priority. Concerns about near-term environmental and fuel economy legislation have not been a priority.

Near-term applications for engines would only need to address lower temperature ceramic materials with less stringent specification and processing requirements (compared to the current program). The primary issues would be lower cost production and consistent quality. These are the kinds of manufacturing improvements that are left to industry.

Question: Is there interest in the automotive or stationary engine industry in doing this?

Answer: There is strong interest in the automotive and heavy-duty (stationary, truck and bus) industry in doing this. As part of our program planning and needs assessment effort, several automobile companies and engine companies were visited and briefed on two proposed initiatives on: cost-effective ceramics for short-term applications in heat engines, and materials solutions for alternatively-fueled engines. The companies visited were Ford, Chrysler, General Motors, Cummins Engine, Norton, GTE, Carborundum, and Caterpillar.

Question: What would have to be done to initiate such a program?

Answers: If a decision is made to initiate such a program, industry cooperation and support will be vital. The program objectives, goals, and work elements must be structured in cooperation with engine and ceramic manufacturers to address the needs for cost-effective ceramics for use in current engine designs. A similar approach would need to be taken for the materials solution for alternatively-fueled engines. Based on a program plan developed from industry inputs, competitive contracts would be awarded to manufacturers to develop the required technology under cost-sharing arrangements. To date, an initial industry needs assessment has been completed for the programs in consultation with engine and materials manufacturers. Final program plans, including work elements, will be structured in consultation with industry.

Question: Please provide an updated list of the users of your High Temperature Materials Laboratory for the record.

Answer:

STANDARD USER AGREEMENTS
HIGH TEMPERATURE MATERIALS LABORATORY
JULY 15, 1987 THROUGH MAY 15, 1990

University - Nonproprietary - 34

Alfred University
Auburn University *
Brown University *
Clemson University
Dartmouth College
Georgia Institute of Technology
Johns Hopkins University
Marquette University *
Michigan Technological University
UCLA
University of Alabama
University of Arizona
University of Cincinnati *
University of Denver
University of Florida
University of Illinois
University of Michigan
University of Minnesota

New Mexico Inst. of Mining & Tech
North Carolina State University
Oklahoma State University
Pennsylvania State University
Rice University *
Rutgers University *
Southern Illinois University
Southern University
University of Missouri-Rolla
University of Mew Mexico
University of So. California *
University of Tennessee
University of Utah
Vanderbilt University
VPI & State University

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* Proposals pending

Industry - Nonproprietary - 36

Allied-Signal
Allison Gas Turbine Div., GM
American Matrix, Inc. +
Carbomedics, Inc.
Carborundum Company
Ceramics Process Systems Corp.
Coors Ceramics Company
Cummins Engine Company
DG Trim Products

Dow Chemical Company
Dow Corning Corp./Midland
Energy Conversion Devices, Inc.
Engelhard Corporation
Ford Motor Company
Foster-Miller, Inc.
Great Lakes Research Corp.
GTE Laboratories, Inc.
IMTech Company
Institute for Defense Analyses
Ionic Atlanta, Inc.
Litton Industries
McDonnell Douglas
Miniature Precision Bearings
Monarch Tile, Inc.
Norton Company
Norton TRW
Nuclear/Aerospace Materials, Corp.
ReMaxCo Technologies, Inc.
Selee Corporation
Sullivan Mining Corp.
Tenn Center for R&D
Textron Specialty Materials
Thermacore, Inc.
Third Millennium Tech., Inc.
United Technologies, Inc.
Universal Energy Systems, Inc.

+ Out of business

Industry - Proprietary - 17

American Superconductor
Armstrong World Industries
Carbomedics * +
Caterpillar, Inc.
Cummins Engine Company +
Dow Corning Corp./Wright
Engelhard +
E. I. DuPont
Ethyl Corporation
Hercules *
Martin Marietta Aero & Naval Systems
Mobil
Norton Company +
Norton TRW +
Singleton Laboratories
Vanderbilt University *
Westinghouse Electric Corp. Sci & Tech, Center *

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* Proposals pending
+ Have executed both nonproprietary and proprietary agreements

Other Government Facilities - 4

Albany Research Center (USBOM)
Bureau of Mines, Tuscaloosa, Alabama
EG&G Mound Applied Technologies, Inc.
National Institute of Standards and Technology

Summary:

34	agreements with	33	Universities
53	agreements with	48	Industries
4	agreements with	4	Other Government Facilities
91	agreements with	85	different institutions.

Question: Congress added funds for two new user centers at the laboratory in FY 1990. Are operational funds for those centers included in the 1991 budget?

Answer: The $2.8 million requested in FY 1991 will support the original four centers and the two new centers for which monies were appropriated in FY 1990.

Question: Are additional funds required to equip the new centers fully?

Answer: No additional funds are required in FY 1991. In FY 1990, both operating and capital equipment funds were added to the appropriation for the addition of two new user centers at the HTML--a Ceramic Specimen Preparation User Center and a Residual Stress User Center. To finally complete these centers, an additional $300,000 would be required for capital equipment. However, due to delivery and installation schedules, these funds would not be required until FY 1992.

Question: If so at what cost, for what equipment?

Answer: The $300,000 would be used to purchase equipment for the neutron portion of the Residual Stress Center.

Question: Is there a need for additional user centers at the Laboratory?

Answer: Our primary focus at this time is to get the two new centers in an operating mode before other centers are considered. In addition to our own perceptions of what may be needed in the future, we look to our users for input as to what capabilities the industrial and university communities would like to have available as user facilities.

Question: If so, describe what functions they would have and the cost to establish and operate them.

Answer: Although we have not identified the need for additional user centers at this time, we continue to identify additional needs for the existing user centers based on the input from a growing base of users and the knowledge generated by them in working on their needs.

Question: In addition to the equipment for the two centers, what additional equipment is required for the Laboratory?

Answer: A scanning transmission electron microscope with the capability for probing ceramic composition interfaces on a scale of a few nanometers has recently become available. This instrument would greatly improve the capabilities of the existing user centers. In addition, several existing equipment upgrades have been recommended by the users.

Question: What would be the cost of the equipment?

Answer: The addition of the TEM instrument to the HTML would require $1.2 million for the microscope. The addition of equipment upgrades would require an additional $300,000. Based on delivery and payment schedule of forecasts, funding could be distributed as indicated below:

	($ in thousands)		
Description	Year 1	Year 2	Total
High Resolution Analytical TEM	800	400	1,200
Work Station System	30		30
Furnace for Scanning Calorimeter	50		50
Environmental System for Cyclic Fatigue	120		120
Heat Attachment for Laser Flash Diffuser		30	30
Upgrade System for ESCA/SIMS		35	35
Upgrade System for DTA/TCA		35	35
Totals	1,000	500	1,500

Question: What capabilities would it add?

Answer: The capabilities which this equipment would add are as follows:

- High Resolution Analytical TEM - The ability to determine the elemental composition of grain boundaries and interfaces in materials is a critical tool for relating the high temperature mechanical properties to the composition and processing requirements which provide optimum reliability. This is especially critical for advanced structural ceramics, such as silicon nitride and silicon carbide, and advanced alloys such as nickel-based superalloys and nickel and iron aluminides. Analyses must be made over a region of the material no greater than about 0.5 nanometers and only now are electron microscopes capable of such analyses becoming available. The requested instrument is a state-of-the art instrument having a field emission gun (required to provide sufficient electron flux for rapid elemental data collection) and image resolution (0.3 nanometers).

- Work Station Equipment - In order to accelerate the collection and analysis of data from the major characterization instruments in the HTML user stations, it is necessary to obtain a fast microcomputer for collecting data and performing the required analyses with the users. In many cases the users do not have the sophisticated computing equipment for this purpose at their home installation. The work station will be either a fast 80386 or 80486 based machine.

- Furnace for Scanning Calorimeter - Many requests have been received from potential HTML users for the ability to determine the specific heat of materials under highly controlled atmospheres. The environmental furnace for the scanning calorimeter would allow study of the specific heat of materials sensitive to oxidation at high temperatures under highly controlled atmospheres. The present scanning calorimeter at the HTML has only inert or oxidizing atmosphere capability.

- Environmental System for Cyclic Fatigue Studies - The key to developing high reliability high temperature structural ceramics lies in understanding and controlling the cyclic tensile fatigue of these materials. This system would provide the ability to study tensile cyclic fatigue of silicon nitride and silicon carbide and simmilar ceramics under well-controlled conditions to at least 1,400 degrees Centigrade.

- Heat Attachment for Laser Flash Diffuser - The specific heat attachment for the laser flash diffusivity system in the HTML would provide users with the capability to determine directly the specific heat from the laser flash diffusivity system. Several users have requested this capability as it would save time and effort in translating thermal diffusivity values for a given material directly into specific heat values.

- Upgrade System for ESCA/SIMS - The ESCA/SIMS system in the HTML has been used extensively by both industrial and university users. During the past year, the HTML has received several requests from industry for the ability to fracture larger specimens than the current stage can accommodate. The upgrade would provide this capability. The requested funding would also provide for rapid downloading of the large image files produced in this instrument and therefore reduce significantly analysis turn around time.

- Upgrade System for DTA/TGA - Many requests have been received at the HTML for the ability to perform differential thermal analysis (DTA) and thermal-gravimetric analysis (TGA) in controlled and corrosive atmospheres. The present system has only the ability to perform analysis in inert or oxidizing atmospheres. The requested system would allow analyses to be conducted in a wide range of corrosive atmospheres at temperatures up to about 1,400 degrees Centigrade.

Question: Why is this equipment purchase being delayed? (p. 350)

Answer: The equipment purchase was not actually delayed. At the time of preparation for the FY 1991 budget, the availability of a new high quality scanning transmission electron microscope was uncertain, and equipment upgrades were not identified by the users.

Magnetically Levitated Transportation Systems (Maglev)

Question: What role is the Government expected to play in the development of such systems?

Answer: The research and development costs for a next generation Maglev technology system are estimated at approximately $1 billion and will require nearly a decade of intensive effort with a much longer payback period. With such a large initial investment and accompanying financial risk, U.S. industry has not been eager to enter the Maglev development race. The reluctance of the U.S. industry to assume the risk of Maglev development is demonstrated by the fact that no American companies responded to the recent request for proposals on the Orlando, Florida, Maglev system or the California-Nevada system.

To encourage development of Maglev technology by private industry, the Federal Government can help remove institutional barriers. The Federal Government can also ensure that Maglev development is consistent with national transportation policy and meets the Nation's transportation needs. A primary benefit of Federal leadership would be to achieve the long-term goal of establishing system compatibility for a national Maglev network. Early Government involvement would also ensure the development of safety, health and environmental standards for the construction and operation of Maglev systems.

Question: Is there a role for U.S.-based technology for systems in the longer term?

Answer: Even though U.S. leadership in levitated transportation has eroded in the past decade, the U.S. still has the finest, most comprehensive technical base in the world. Analysis of the critical technologies needed to develop and implement a next-generation Maglev system identified seven areas as essential: aeronautics, superconductivity, computers, computer software, instrumentation and control, modular construction techniques, and magnetic/electromagnetic design issues. In each of these areas, the U.S. either leads the world in technical capability or is equal to any competitor. If our capabilities in these areas are aggressively applied in an attempt to develop an advanced Maglev, there is an excellent chance of success.

Question: If so, is the Government involved in looking at this?

Answer: The National Maglev Initiative is a program, announced by President Bush in February, to encourage private sector participation in advanced Maglev system design, construction, testing, validation, and certification, with a Federal Interagency Team developing strategies for private sector participation, addressing technical and economic issues and setting necessary environmental, safety, and health standards. The Federal Interagency Team is led by the U.S. Department of Transportation through the Federal Railroad Administration, supported by the Department of the Army through the Army Corps of Engineers and the U.S. Department of Energy.

To implement the National Maglev Initiative, a three-phase process is underway. Phases I and II consist of the immediate, short-term activities, i.e., gathering data on how best to proceed with the final implementation of the initiative. Phase III consists of the long-term activities required for Maglev implementation.

Question: What is the Department of Transportation's role?

Answer: The Department of Transportation's Federal Railway Administration (FRA) acts as the lead agency for the National Maglev Initiative which includes cochairing the Maglev Interagency Executive and Coordination Committees. One of the primary FRA functions associated with Maglev is the development of safety regulations for Maglev systems. FRA is preparing a preliminary feasibility assessment of Maglev to be delivered to Congress in June 1990. According to current plans of the Interagency Coordinating Committee, FRA will be the lead agency for procurements in the area of technical assessment and developments in FY 1991.

Question: What is the Corps of Engineers' role?

Answer: The Corps' role is to provide support to the Interagency Coordination Committee by the application of its expertise in managing a broad range of complex research and development and engineering and construction projects. The Corps' capabilities include engineering, construction, contract management, cost control, environmental analysis, legal aspects, and real estate.

Furthermore, the Corps maintains four laboratories with expertise in the following technical areas relevant to Maglev development:

structural dynamics, transportation engineering and vehicle analysis, concrete and soils engineering, tunneling, environmental analysis, composite materials at standard and cryogenic temperatures, electromagnetic pulse effects, superconductivity, and vibration and shock analysis. The Corps' laboratories maintain close ties with other members of the research and development community, including other national laboratories, the academic community, and the private sector.

Question: What is DOE's expertise in this area?

Answer: The Department of Energy and its national laboratories have expertise in the physics of magnets which directly relates to Maglev propulsion, levitation, and guidance, and expertise in superconductivity and cryogenics, in energy storage systems such as batteries and superconducting magnetic energy storage devices, and in innovative materials which have benefits in guideway and vehicle design.

Question: Are you involved in assessing the role, if any, of US technology?

Answer: A major thrust in the National Maglev Initiative is to assess the U.S. technology. DOE is involved in every major aspect of the initiative. DOE is represented on and takes an active part in the Maglev Executive Committee, the Maglev Interagency Coordinating Committee and its Technical and Marketing and Economics subcommittees.

Question: What generic areas are there where the United States expertise could be involved in second generation systems?

Answer: Generic areas for U.S. involvement are:

o Levitation and guidance concepts. Innovative designs will reduce cost, reduce magnetic field levels, improve ride quality, and increase energy efficiency.

o Active vibration control. Improve damping will enhance ride quality.

o Aerodynamic design and control. Improved designs and controls will reduce vehicle weight, minimize wild effects, improve efficiency, and reduce noise.

o High temperature superconducting magnets. Compared to low-temperature superconducting magnets, high temperature devices may offer better reliability, reduced refrigeration needs, and lighter weight, simpler cryostats. Usable high temperature magnets may be some years away, however.

o Propulsion systems based on power electronics. Advances in linear-synchronous motor technology will allow smoother and more efficient acceleration and braking.

- o Designs for unlinked vehicles. Compared to multicar Maglev vehicles, smaller, unlinked cars will offer more flexible passenger routing, allow use of lower cost guideway structures, and reduce peak power demands.
- o Materials and designs for guideway structures. Cost can be reduced by using high strength materials and innovative designs for guideway structures.
- o Composite materials for vehicle bodies. Lighter weight vehicles will consume less power and allow use of lower cost guideway structures.
- o High temperature superconducting magnetic screens. Lower weight screens may be possible through high temperature superconductivity.
- o Cryostat designs. Advances will provide better reliability and lower cost magnet systems.
- o Batteries and fuel cells. Improved onboard energy storage systems will reduce vehicle weight and improve the performance of the vehicle's electrical system.
- o Superconducting magnetic energy storage systems. Energy and cost savings will result from efficient wayside systems that reduce fluctuations in line voltage and store energy from Maglev vehicle braking for subsequent use in acceleration.
- o Operations control and management systems. Computerized routing and scheduling systems, similar to avionics controls, will optimize customer service, transportation system performance, and safety.

Question: Is there industrial interest in this?

Answer: Industrial interest in Maglev is growing rapidly. This interest is being stimulated by the more than 12 different local activities that involve studies or proposals for high speed rail or Maglev in the U.S. However, there were no U.S. proposers for the three projects that have actually solicited proposals for Maglev systems. In addition the emphasis in the President's Proposed Budget for FY 1991 and the efforts of the Maglev Interagency Coordinating Committee are contributing to the growing interest.

Question: What level of funding would be necessary to establish the basis for the United States' technological involvement and an overall program plan to develop Maglev systems?

Answer: The proposed budget at DOT and the Army Corps of Engineers for the Maglev initiative in the FY 1991 request is $9.65 million. This funding level is sufficient to carryout the first steps required to establish both the U.S. involvement and development plan.

Question : Is there any funding requested in the budget for any agency to do this?

Answer: In the FY 1991 budget requests, $6.15 million has been requested by the Department of Transportation and $3.5 million by the Army Corps of Engineers. It is planned that some funding from both of the agencies will be transferred to DOE for our participation by means of interagency agreements.

Two-Stroke Engines

Question: What work is underway in 1990 and 1991 within the Conservation program in evaluating the two-stroke engine?

Answer: Under the Combustion Technology Program, formerly of ECUT, experimental efforts featuring specially designed research engine are used with multidimensional modeling efforts to develop comprehensive understanding of the combustion and fluid mechanics of the two-stroke cycle direct injection stratified charge engine concept. The validated computer model will be used by industry to investigate the potential benefits of specific adaptations of this concept.

Question: What advantages are there to this engine?

Answer: There is no operational fleet data on vehicles using these new two-stroke engines on which to predict actual advantages. However, literature from the Orbital Engine Co. claims that the engine will improve fuel economy by 30 percent and decrease emissions as compared to older designs of two-stroke engines by a factor of 10. Other claims include a weight reduction of 50 percent, reduced volume of 70 percent, and reduced costs to manufacture of 25 percent. None of these claims have been substantiated by U.S. vehicle manufacturers to our knowledge although some of the companies are conducting evaluation programs.

Question: What technology has been developed to make this engine environmentally acceptable?

Answer: The Orbital Engine Co. claims the following technology advances have solved the emissions problems:

- Electronic control of fuel injection and exhaust including highly specialized valving.
- New combustion chamber geometry and fuel spray methods.
- Lower engine friction levels and reduced pumping work.

- New catalytic control system.
- An electronic lubrication system.

Question: What is the automotive industry involvement with the engine?

Answer: Both the Ford Motor Co. and General Motors Corp. have licensed technology from the Orbital Engine Co. of Australia and have been evaluating the engine for over a year. Neither company has announced any results.

Replacement of CFCs in Mobile Air Conditioners

Question: What research is being done on replacement of CFC fluids in automobile air conditioners with 1990 funding? (p. 353)

Answer: Research is being conducted in four related areas:

- Lawrence Berkeley Laboratory (LBL) is conducting research into thin-film coatings for automobile windows which will significantly reduce the solar heat gain into the passenger compartment. This heat gain reduction may permit the use of new non-CFC air conditioning systems, increase passenger-comfort, and reduce fuel consumption.
- Through a cooperative effort with the Department of Transportation, an investigation is being made into the feasibility of using common hydrocarbons such as propane, as air conditioner working fluids in place of CFCs.
- Oak Ridge National Laboratory (ORNL) is conducting a technology assessment of alternative non-CFC based air conditioning technologies which can be adapted to the automobile. This work takes into account the reduced cooling loads predicted by LBL through the advanced coatings work described above.
- ORNL is also investigating the feasibility of developing a CFC/non-CFC mixture for use as a drop-in refrigerant. This will prevent the premature obsolescence of CFC-based systems when CFC production is phased out.

Question: Is this an area of concern?

Answer: This is an area of great concern since CFC production may be phased out by the year 2000 and presently no safe, effective, and economically feasible alternative exists for the automotive sector.

Question: If so, why is 1991 funding not requested?

Answer: The investigations on reducing or eliminating the use of CFC refrigerants in automotive air-conditioning systems are new initiatives which will be started in FY 1990. Until the investigations are complete, it is not clear that additional government support is necessary. The investigations will continue into FY 1991 using FY 1990 funds. Private industry is already making a serious commitment to addressing this issue, even without Federal funding.

Question: Is work in other areas sufficient to satisfy automotive needs?

Answer: Work in other areas will not completely satisfy automotive needs, although some work will be transferable. Automobile air conditioners operate in a more severe environment than stationary refrigeration systems do. The CFC industries are looking at both types of applications very seriously.

Question: What additional work is necessary in this area to find substitute materials or systems?

Answer: Additional work is required in several distinct areas which can contribute to finding a suitable alternative to CFCs:

- o Advanced electrochromic switching glazings, which can significantly reduce solar heat gain. Angle selective glazings can further reduce the solar heat gain.
- o CFC/non-CFC mixtures which will help to extend the service life of existing CFC-based mobile air conditioners.
- o Alternative refrigeration cycles which have the potential for automotive application without requiring CFC working fluids.
- o Non-CFC means of providing cooling for refrigerated and frozen food transport by truck and rail.
- o Non-CFC means of providing air conditioning for transit buses.
- o Alternative non-CFC working fluids for automotive air conditioners.

Gas Mileage Guide

Question: Why is funding not included for publishing and distributing the model year 1992 Mileage Guide?

Answer: It was presumed by the Department that legislation would be submitted and passed to remove the EPCA (Public Law 94-163) requirement that the Gas Mileage Guide be produced and distributed to all new car dealers. The Department will make sure that the information contained in the mileage guide is available to consumer and automotive publications, which typically publish this information. Such commercial publications reach a very large number of potential car buyers.

Question: What would it cost to do so?

Answer: It is estimated that it will cost $700,000 to prepare the information, generate mailing lists, produce the documents, and make the necessary distribution to all new car dealers.

DOE's Role in Automotive Transportation

Question: What do you see as your role in automotive transportation?

Answer: The overall role of the Transportation program in DOE's Office of Conservation and Renewable Energy is to work with the private sector and serve as a catalyst to improve the energy-use efficiency of the transportation sector and enhance the flexibility of fuel use options in transportation-related technologies. Efforts are responsive to energy, economic, and environmental goals. Consideration is given to near-, mid-, and long-term requirements with a balanced focus on supply, demand, and infrastructure. In addition to traditional areas of advanced propulsion systems development, alternative fuels utilization, and advanced materials technology development, increased emphasis is centered on development of biomass-derived fuels and collection, analysis, and distribution of reliable, compatible data on performance and emissions of alternative fuels/engine design combinations.

Question: Has this role changed over the past few years?

Answer: The actual fuel economy, efficiency, and alternative fuels utilization objectives have not changed, but some changes in emphasis have occurred. A more balanced structure which attempts to integrate short-term, mid-term, and long-term goals has emerged, and environmental impacts are receiving increased concern.

Question: Are you involved more in shorter term activity than previously?

Answer: There is more involvement in shorter term activity than in the past for two reasons. First, as a natural result of our successful R&D activities, some technology areas which were originally considered long term have progressed to the point where they are now considered short term. Second, primarily because of the growing concern with air quality, more near-term technology developments or technology spinoffs are receiving increased attention.

Question: Do you participate more actively with the industry, EPA, or State regulators than in the past?

Answer: The Transportation program has always maintained an aggressive and active relationship with industry, both in the design and the implementation of program activities. This relationship is actually growing because of the increasing threats of foreign competition combined with environmental concerns. Environmental issues and the implementation of the Automotive Motor Fuels Act has also greatly increased our involvement and cooperative efforts with the EPA and State and local regulators.

Question: What is your role with regard to regulatory issues?

Answer: The Department has been involved in two key regulatory issues affecting automotive transportation. The Corporate Average Fuel Economy (CAFE) Standards and the mobile source provisions of the Clean Air Act. DOE's Office of Policy, Planning and Analysis has played the lead role on these issues, in interacting with Congress and other agencies. The Office of Transportation Technologies has played a supporting role in providing background data and specific analyses.

Question: Do you take an active role in this area?

Answer: The Office of Transportation Technologies' role has been active in that assistance is provided to the Office of Policy, Planning and Analysis in defining issues and possible solutions through supporting data and analysis derived from our propulsion systems and fuels research efforts.

Question: Are you more active within the Administration on transportation issues?

Answer: As attention to the environmental and energy security consequences of transportation energy use has increased, we have become more involved in some of these issues. One example of this is the concern over carbon dioxide emissions from transportation fuel use and investigations into ways to mitigate this problem. Since this is a relatively long-term issue, our work in biomass-based fuels, electric vehicles, and advanced engine concepts has become more relevant than it might be to a shorter-term regulatory issue such as near-term fuel economy or emissions standards.

Transportation Capital Equipment

Question: The budget (p.350) says you are delaying the purchase of electric vehicle testing equipment.

Answer: The purchase of equipment for the electric vehicle test facility at the Idaho National Engineering Laboratory was delayed until a more complete assessment of the laboratory requirements could be made and new data collection hardware thoroughly evaluated.

Question: What equipment is needed and at what cost? Why are you delaying its purchase?

Answer: To bring the test facility up to current standards will require a new data acquisition system and power measuring equipment for the dynamometer facility; and new battery chargers, optical data storage disks, additional data acquisition hardware, and miscellaneous spare parts for the battery test facility. This equipment will be purchased with the $300,000 appropriated in FY 1990.

Question: Why is equipment being provided to the Colorado School of Mines?

Answer: Equipment is being provided to the Colorado School of Mines to complete the emissions test facility being established by the School in cooperation with the Regional Transportation District, the Public Service Company, and the State of Colorado. The facility will provide a unique integrated capability to conduct high altitude emissions tests required for both the Alternative Motor Fuels Act demonstration activities and atmospheric modeling studies.

Question: Are there other facilities that can do the same testing?

Answer: There are no other facilities that can conduct engine or vehicle chasis dynamometer emissions tests under high altitude conditions.

Priority Areas for Additional Funds

Question: If funding equivalent to 1990 presequestration levels were available for transportation programs, in what areas, in priority order, would you recommend funds be allocated?

Answer: The FY 1991 request for Transportation of $56,600,000, compared to an FY 1990 presequestration level of $65,686,000. If an additional $9,086,000 were made available, it could be applied in the following activities:

	($ in thousands)	
	Funding	Cumulative
FY 1991 Request	56,600	56,600
Automotive Gas Turbine Program	5,000	61,600
Electric Vehicle Battery R&D	4,086	65,686
Total -	$65,686	

However, we believe that the FY 1991 budget request for transportation programs is appropriate and well balanced, and adequately funds the most promising technologies.

Industrial Conservation

Question: In reviewing the "summary of changes" pages of the budget justification for industrial conservation (p. 310-311) the word "decrease" is connected with almost all technology programs (actual research and development projects) and "increase" is connected with National Lab support, technology transfer, and Energy Analysis and Diagnostic Centers, all of which are non-research and development activities.

How does this "increase" the emphasis on energy efficiency that is the supposed cornerstone of the National Energy Strategy?

Answer: In the past, the primary focus of the industrial energy conservation program has been on long-term, high-risk research and development. The increased emphasis in the FY 1991 budget request on technology transfer, and the Energy Analysis and Diagnostic Centers, reflects an attempt to bring the program into better balance in terms of assuring that actions which can save energy in the near term are emphasized as well. This is consistent with the emerging National Energy Strategy, and the realization that there are many near-term applications of energy efficient technologies that can help the nation meet its energy and environmental needs.

Question: Does the proposed budget slow down or eliminate any ongoing research and development?

Answer: At the funding levels proposed, delays would be incurred in a few program activities. No on-going projects deserving of continued support would be eliminated. The coal-fired Brayton cogeneration system will be completed with FY 1990 funds.

Question: If so, please provide the Committee a listing of the projects or project areas and the cost to keep them on previous schedules.

Answer: The schedules of certain projects were changed in the areas of waste conversion, cogeneration, separations, sensors and controls, industrial heat pumps, and high temperature recuperators. Additional funds are not required, as the proposed budget will allow for orderly continuation of on-going work.

Question: If funding equivalent to 1990 presequestration levels were available in industrial conservation programs, in what areas, in priority order, would you recommend funds be allocated?

Answer: The FY 1991 request for industrial energy conservation was $40,100,000, compared to an FY 1990 presequestration level of $51,400,000. If an additional $11,300,000 were made available, it could be applied to the following activities:

	($ in thousands) Funding	Cumulative
FY 1991 Request	$40,100	$ 40,100
Liquid/Solid Waste Utilization	+1,300	41,400
Baseline Indus. Use Studies	+2,000	43,400
Continuous Fiber Ceramic Comp.	+4,500	47,900
Materials Processing (Metals Initiative)	+3,500	51,400
Total	$51,400	

Metals Initiative

Question: The 1991 budget includes $8,600,000 for the metals initiative. (p.327) What is it expected to cover?

Answer: $8,600,000 has been requested in the FY 1991 budget. These funds will cover completion of Phase I of the spray casting project and continuation of the direct steelmaking project.

TOTAL FY 1991 REQUEST	$8,600,000
Spray Forming - Phase I	565,000
Direct Steelmaking	6,000,000
Balance	$2,035,000

The balance of the FY 1991 funds ($2,035,000) will be used for either:

(1) Initiation of Phase II of the spray forming project. Phase I of this project is scheduled for completion in March 1991. The decision to proceed to Phase II will be made based on Phase I results and commitment by the industrial participants to meet the cost-share requirements for Phase II. As proposed by INEL, Phase II is a three year program requiring $16,400,000 of DOE funds; however, a revised Phase II proposal is expected to be submitted to DOE in the 1Q of FY 1991, or

(2) Initiation of Phase IIB of the superplastic steel project. If Phase IIA of this project is successfully completed in the 3Q of FY 1991, industry will determine if further development is needed for commercialization and continuation to Phase IIB may be proposed. As currently proposed by LLNL, Phase IIB requires $1,500,000 of DOE funds, or

(3) Continuation of the new projects initiated with FY 1990 funds.

Question: Will that allow continuing existing projects at levels necessary to continue on schedule?

Answer: Yes. Three projects are currently being funded - direct steelmaking, spray forming and superplastic steel processing. In addition, DOE anticipates that two additional projects will be funded in FY 1990 with FY 1990 funds. The FY 1991 request contains funding for direct steelmaking which is consistent with the current cooperative agreement, for completing Phase I of the spray forming project, and for initiation of new projects. We currently anticipate that existing projects will continue on schedule.

Question: How much money would be required to fully fund all of the projects now under way, or expected from AISI, assuming continued progress on each?

Answer: If all ongoing projects are technically successful, remain on schedule, and continue to receive industrial support, the following funding would be necessary in FY 1991:

1. Direct Steelmaking - $7,500,000 - six million was requested for FY 1991, which is consistent with the current cooperative agreement. The additional $1,500,000 prepared by AISI would be used to accelerate the pace of development.

2. Spray Forming, Phase I - $565,000

3. Spray Forming, Phase II - $2,035,000. This is an estimate only, as no Phase II proposal has yet been received.

4. Superplastic Steel, Phase IIB - $1,200,000.

If contract negotiations on two new proposals are successfully concluded before the end of FY 1990, we expect to spend $2,346,000 of FY 1990 funds for those projects, with an additional $700,000 available for new or ongoing work. It is possible that the following funds might be required in FY 1991 for the new projects:

1. Thin Strip Casting - $1,990,000

2. Aluminum Cell Cathodes - $910,000

Thus, if all projects currently underway or planned continue to be satisfactory, a total of $14,200,000 could possibly be required.

If a proposal on intelligent processing is received from AISI and meets DOE requirements, it is possible that an additional $4,000,000 could be required in FY 1991 for a total of $18,200,000.

However, given the uncertainty of the various stages of these projects, we believe that the request of $8,600,000, plus the $700,000 available from FY 1990, is appropriate for FY 1991.

Question: If not, how much more funding would be necessary to do this, and also keep other projects on schedule?

Answer: We expect to keep all projects on schedule with our requested funding level.

Question: Please provide details for the record of the funding in 1990 for each of the ongoing projects and the 1991 requirement for each if they go forward.

Answer: The details of funding for FY 1990 and FY 1991 are shown below:

	FY 1990	FY1991
Direct Steelmaking	9,254,000	6,000,000
Spray Forming, Phase I	3,886,000	565,000
Superplastic, Phase IIA	706,000	-
Projects Initiated with FY 1990 funds	3,054,000	
To be determined*	-	2,035,000
TOTAL	16,900,000	8,600,000

*$2,035,000 will be used for either initiation of Phase II spray forming, or Phase IIB, Superplastic Steel based on consultation with industry, or continuation of new projects initiated with FY 1990 funds.

Question: What additional funds are available for obligation in 1990?

Answer: $3,054,000 of FY 1990 funds remain to be obligated. However, DOE anticipates that these funds will be obligated in FY 1990 to two new projects, titanium diboride/graphite cathodes for Hall-Heroult alumina reduction cell and near net shape casting of steel sheet and strip.

Question: When will you decide what projects to fund?

Answer: It is anticipated that financial assistance awards will be made during the fourth quarter of FY 1990.

Question: How much of the proposed FY 1991 funding is unallocated to specific projects?

Answer: $2,035,000 will be used for either initiation of Phase II Spray Forming, or Phase IIB Superplastic Steel based on consultation with industry, or continuation of new projects initiated with FY 1990 funds.

Question: What is your opinion as to the state of the program?

Answer: The Metals Initiative was initiated in 1988, as a follow-on program to the "Steel Initiative" which had been legislated previously. Its purpose is to increase energy efficiency and enhance industrial competitiveness within the primary metals industry, by establishing public-private sector research and development partnerships to undertake scientific research and development. This is being accomplished by a collaborative research and development effort which is closely coordinated with the industry. The Program is becoming recognized throughout the primary metals industry as a very effective means for organizing and conducting research and development.

Question: How long will it be before significant results will be available?

Answer: Technology is already available for licensing from the former Argonne National Laboratory project - electromagnetic casting of steel. Meaningful results have been obtained from Phase I of the Superplastic Steel Processing project regarding casting and forging of a superplastic steel alloy; in addition the technical hurdles that must be overcome to insure commercial viability for superplastic steel have been quantified, and will be pursued in Phase II. As part of the direct steelmaking project, positive results have been obtained from the large scale post combustion/heat transfer trials undertaken in a commercial basic oxygen furnace shop equipped with combined blowing. This work is expected to lead to increased scrap melting capability in existing operations thereby improving energy efficiency and reducing steelmaking costs. Significant results from the direct steelmaking project's pilot plant experiments are expected to be available next year. Significant results from the spray forming project can be expected upon the completion of Phase I, scheduled for March, 1991.

Ceramic Composites

Question: What markets would be the target of this technology?

Answer: A wide range of industry could benefit by use of Continuous Fiber Ceramic Composites (CFCC) components. The two target markets being considered are process vessels, heat exchangers and power generating turbines. It is likely that additional applications will be found as the industrial sector becomes more aware of the beneficial properties of the CFCC materials.

Question: With what materials do these composites compete?

Answer: Because of their greater corrosion resistance and ability to withstand high temperature, there is the likelihood that the CFCCs could displace metals or plastics in some applications. However, it is more likely that the CFCCs will "enable" the development of advanced processes to which currently available materials are not applicable. The target applications being considered -- process vessels, heat exchangers and stationary turbines -- currently use high temperature alloys.

Question: What are their advantages and disadvantages?

Answer: The CFCCs take advantage of the corrosion resistant and high temperature structural properties of monolithic ceramics and overcome the brittle fracture properties inherent in those materials. As a structural material, CFCCs are stronger than most plastics, lighter than most metals, more resistant to corrosion and oxidation than either plastics or metals, and retain their strength at temperatures beyond the melting point of metals. The major disadvantages of the CFCC material relate to the high cost of producing products from these materials, and the fact that they are more brittle than metals.

Ceramic Composites

Question: How is this technology related to that being developed in the advanced materials program?

Answer: There is a relationship in that some of the material testing and non destructive evaluation (NDE) technology being developed in the advanced materials program may be applicable to the matrix materials of the CFCCs. The advanced materials program is developing ceramics for vehicular transportation applications. These applications demand components developed for the heat engine environment. This generally requires a limited number of component configurations, in a smaller size range, but produced in very large volumes. Key materials are non-oxides such as silicon nitride. The CFCC Program is developing ceramic composites for industrial applications. These applications may be found in a wide range of use environments (from chemical processing to metal melting to hazardous waste heat recovery). This will require development of a wide range of component configurations, in a range of sizes from small to very large, but produced in limited volumes. Key potential materials are carbon, glass, and ceramic fibers, and oxide ceramics such as alumina (although non-oxides such as silicon carbide are also likely to be used). We hope to use many of the techniques and processes developed in the advanced materials program and to learn from their past experience.

Waste Energy Reduction

Question: What is the industrial application of the "supercritical wet oxidation process?"

Answer: There are many industrial applications for the supercritical wet oxidation process. It may be used to generate process steam or electrical power from process materials available. It also may be used to sterilize hazardous wastes streams while recovering the embodied energy. Some examples are the discharge from breweries, food wastes from soup making plants, contaminated wastes from pharmaceutical plants, wood wastes, and the processing of low grade fuels such as peat or the wash water waste from coal processing plants. The treatment of paper mill sludges to destroy the dioxins that are sometimes present is another industrial application under consideration.

Question: How many host sites are you selecting for advanced industrial heat pumps?

Answer: Phase I of the Advanced Prototype Industrial Heat Pump (IHP) Project investigated 14 processes at 14 industrial host sites. Of the 14 host sites screened, 8 of the host sites identified IHP opportunities with favorable economics (ie. 0.5 year to 4 year payback on capital investment based on the energy savings to be achieved). In addition, the 8 host sites are interested in installing the IHPs as a means to improve plant productivity and to reduce environmental emissions. The 8 host sites showing IHP opportunities indicate a willingness to proceed to Phase II. DOE has received one proposal for Phase II. The industrial cost share on this particular project is 33%. Planned funding levels will allow DOE to participate towards a Phase II final IHP design at 5 of the 8 projects. Actual fabrication, installation and field test of IHPs with present DOE funding levels and reasonable industry cost share (ie. above 50 %) will allow for at least 2 IHP installations.

Question: What industrial involvement is there in this program?

Answer: This program was originally developed by the Department of Energy (DOE) and the Electric Power Research Institute (EPRI) in 1987. As a result, DOE and EPRI each funded 14 projects. Phase I started in late 1988. Most project contracting teams include a process engineering company, an industrial host site and, a sponsoring electric utility. The process engineering companies involved on the DOE projects are Linnhoff March, Tensa Services, Kinetics Technology International Corporation and Litwin Engineers & Constructors. The U.S. electric utilities are interested in the Pinch process integration method since it is a way of assisting their industrial customers in the identification of improved energy utilization methods and alternative electrotechnology approaches. DOE is working jointly with the Electrification Council (TEC), EPRI and individual utilities to promote the acceptance of advanced industrial heat pumps in the market place. The specific electric utilities involved on the DOE projects are: Southern Company Services, Gulf States Utilities, Duke Power, Oklahoma Gas & Electric, Utah Power & Light, Niagra Mohawk and Pacific Power. The industrial host sites which have expressed willingness to proceed to Phase II of this project are: South Hampton Refining, Chevron Chemical, American Maize, Bowater Carolina Paper, American Synthetic Rubber Corp., Kerr McGee Refining and Fieldcrest Cannon Textiles. The industrial cost share on Phase I was 25%. It is expected that there will be an industrial cost share of 33 and, 50 to 80% (depending on individual project factors) on Phase III (ie. equipment fabrication, installation and test).

Question: In addition to ceramic composite work, what other work is contemplated in advanced high temperature recuperators?

Answer: Specific tasks included in the FY 1991 budget are to develop the HiPHES advanced reformer, to develop composite gel casting to decrease porosity in ceramic composite components, to continue studies of fiber architecture, to complete strength limiting flaw studies of monolithic ceramic heat exchanger components, to test heat exchanger tube enhancement devices in an industrial environment, and to fabricate and test high temperature corrosion and fouling probes.

Question: Are these technologies competing or complementary to composite technology?

Answer: These technologies are either complementary to (e.g., the knowledge gained in developing monolithic ceramic NDE provides the basis for the development of NDE for composites) or they will benefit from (e.g., in the long run the HiPHES advanced reformer will probably use composite components) the development of composite technology.

Question: What is the scope of your work in biodegradable plastics?

Answer: The scope of work in the biodegradable plastics from waste project is covered under an Argonne National Laboratory proposal entitled "Bioconversion of High-Starch Food Wastes into High-Value Products." Initial focus of the work is on potato wastes and cheese whey waste-to lactide copolymers. The process works in three steps:

1. Conversion of the carbohydrates to monomeric glucose/sugar
2. Conversion of the glucose/sugar to lactic acid with purification
3. Conversion of the lactic acid to a polymer lactide (degradable plastic)

The present work has elements that address all three parts of the process. The reduction of saccharification and fermentation times and finding the easiest method of polymerization of lactic acid are being focused on.

Question: What industrial interest is there in this work?

Answer: There is extensive current industrial interest in the starch waste to biodegradable lactides upon which the Department's research is focussed. Archer Daniels Midland, Borden, Dow Chemical, J.R. Simplot, Proctor and Gamble, Southern Research, Union Carbide and over 125 other companies have expressed interest as of May 15, 1990. There is interest in forming a consortium of 5-10 companies to pursue the research. Current cost-sharing has been provided by Enzyme Biosystems, Universal Frozen Foods, State of Illinois Challenge Fund, and Tennessee Valley Authority. Total cofunding (as an example of outside interest) has been $408,000 as of May 1990. Other processes that convert starch to different polymers should also attract interest.

Question: Is there more than one process involved?

Answer: Yes, there is more than one process in the sense that several steps are involved.

The overall process of going from waste to biodegradable plastic mulch film can be broken into several steps:

For Potato waste they are:

1. Liquefaction of waste
2. Saccharification
3. Continuous fermentation
4. Separation/purification of lactic acid
5. Polymerization of lactic acid
6. Fabrication of plastic into film

Question: What applications are there for the plastic material being developed?

Answer: The identified applications for photo/biodegradable plastics are:

	Existing Annual Demand
Degradable, controlled release coatings for fertilizer and pesticide use.	>1,000,000,000 lbs
Agricultural mulch films	150,000,000 lbs
Specialty sacks/bags, especially compost waste bags	50,000,000 lbs
Marine plastic applications	500,000,000 lbs
Degradable conditioner coatings for paperboard stock	200,000,000 lbs
Protective seed coatings for reseeding forests, for example	Unknown lbs
Total	over 1,900,000,000 lbs

Currently, lactide copolymers are used for prosthetic implants, sutures, and timed drug release such as insulin or birth control. The breakdown products are nontoxic and metabolizable. (i.e. lactic acid)

Research indicates that the breakdown products of the plastic in the environment will be as C2-C12 polymer fragments that are known plant growth promoters. The mulch film application looks very good because: the film would not have to be removed at the end of the growing season; photodegradability is easily incorporated in the biodegradable plastic; nutrient release as in phosphate and urea release rate can be potentially tailored to the requirements of the plant; herbicide/pesticide can also be tailored; and the breakdown products are themselves a growth stimulant.

Question: Have you formed a consortium as announced last year to develop adhesives from wood wastes?

Answer: Yes, a consortium has been formed to develop adhesive from wood wastes for wood and other industrial applications, based on research conducted at the Solar Energy Research Institute. The name of the registered consortium is the Pyrolysis Materials Research Consortium.

Question: Who is in the consortium?

Answer: There are six members of the Consortium:

1. Pyrotech, Inc, subsidiary of INTERCHEM Industries, Inc.
2. Allied-Signal, Inc.
3. Aristech Chemical Corporation
4. Georgia-Pacific Corporation
5. Plastics Engineering Company (PLENCO)
6. MRI Ventures, Inc. -holding company/administrator of consortium

Question: When is it expected that the adhesive product will be commercial?

Answer: We currently estimate that the first commercial non-pilot applications of this technology will occur in 1996.

Question: What is the overall significance of your work on metal scrap?

Answer: The work 1) protects the present level of recycling from new contaminants, in a market that demands higher performance materials and 2) develops technologies to utilize scrap metals not presently being utilized.

The benefits are reduced costs for US manufacturing industries and reduced energy consumption and reduced importation of metals and finished goods.

In 1985 the secondary metals industry recycled in excess of 50 million tons of metal. This recycling conserved in excess of 1 Quad of energy. There are two alternatives to this recycling: 1) import these metals or 2) produce from ores at an energy cost of over one quad.

Question: What kind of metals are not recovered economically now?

Answer: The following are examples of metals not recovered economically now:

- Aluminum in secondary smelter salt cake (dross);
- Non-magnetic iron ore in taconite tailings (nearly as much as the magnetic part that feeds our steel industry);
- Steel and aluminum lost in the auto shredder residue;
- Lead and zinc in batteries that are being landfilled.
- Cadmium, chromium, lead, mercury, silver, gold, aluminum, copper, iron, nickel, titanium, and zinc present in the fly ash and bottom ash of municipal solid waste incinerators; and,
- Steel, aluminum and zinc present in the 20 million tons per year of obsolete autos and machinery that are presently not being processed.

Question: Does the Bureau of Mines do any work in this area with regard to recovering metals?

Answer: Yes, what they are doing includes:

- Survey on strategic and critical materials recycling.
- Recovery of platinum from auto catalytic converters.
- Conservation of materials in the metal annealing and pickling processes.
- Recovery of chromium, cobalt and nickel from mixed and contaminated super alloy scrap.
- Critical metals recovery from advanced materials scrap e.g., rare earth permanent magnets.
- Identifying characteristics and recycling of advanced materials and alloys (including composites).
- Recovery of gallium and germanium from domestic resources e.g., gallium from primary zinc industry wastes.
- Recovery of vanadium from catalysts (petroleum refining).

They are commercializing a process to recover lead from lead sulfate, using H2SF6 acid (instead of smelting) from previous auto battery recycling sites (now super-fund sites).

Question: In utilization of stack gas (p. 320) it appears that you are stopping two projects in 1991; one on silicon monoxide and one on hydrogen and sulfur recovery. Why?

Answer: Work on the Silicon Monoxide and Hydrogen & Sulfur projects will be delayed due to higher priority projects being funded in FY 1991. We anticipate continuation of these activities in FY 1992.

Question: If they are feasible projects, what would it cost to continue each in 1991?

Answer: Both projects are feasible. The FY 1991 cost for continuing the Silicon Monoxide project without delay would be $750,000. The cost for continuing the Hydrogen & Sulfur project would be $500,000.

Question: Why is it necessary to increase National Laboratory support in 1991 by $900,000 above 1990?

Answer: We are spending less for National laboratory support in FY 1990 than during the preceding few years. However, funds carried over from prior years will be nearly all expended by the end of the fiscal year, in order to make up the difference between the FY 1990 appropriations and the amount actually required. This accounts for about $500,000 of the $900,000. The remainder reflects increased analytical and technical support for programs which are getting more attention, such as waste conversion.

Question: For whom is the support allocated in each year?

Answer: The funds have been, and are projected to be, allocated as follows:

($000)

	FY 1990	FY 1991
Idaho National Engineering Laboratory	$1,548	$2,300
Argonne National Laboratory	360	500
	$1,908	$2,800

Industrial Process Efficiency

Question: In Process Electrolysis, it is difficult to ascertain from the budget justifications what industries the projects are in, and if they are being pursued to fruition. (p. 325-26) For example, what happens to the work on cerium-oxide coated cermets, based on pilot cell tests? (p. 325)

Answer: In Process Electrolysis, about 85 percent of the activities are for aluminum production. All projects will be pursued using either Process Electrolysis or Metals Initiative funds. The pilot-scale test work on cerium oxide coated cermets should be complete in the 1Q of FY 1991. If the results of this work are promising, the subsequent research and development will be considered for funding under the Metals Initiative program using FY 1992 funds.

Question: What is the next logical step after Phase II of the work on a low temperature alumina cell? (p. 325)

Answer: The next logical step after Phase II is to perform experiments in a 20,000 ampere cell and to determine the design for a commercial cell. At that stage, industry should be taking over responsibility for managing and funding development.

Question: What were the results of the pilot scale tests of titanium diboride graphite cathodes? (p. 326)

Answer: The results were very encouraging. The mechanical and electrical characteristics of the material were excellent. Voltage reductions required for energy savings were demonstrated. Chemical stability has been shown on test samples in commercial cells for 14 months. It is anticipated that this development will be continued under the Metals Initiative program using FY 1990 funds and that a financial assistance award will be made in the fourth quarter of FY 1990.

Question: Are there any aluminum industry projects that are being pursued that might become eligible for Metals Initiative finding?

Answer: Yes. In addition to the titanium diboride/graphite cathode development, two other aluminum industry projects may become eligible for Metals Initiative funding: cerium oxide coatings on the cermet anode, and Phase III of the high surface area anodes in low melting point baths.

Question: If so, please describe their status?

Answer: CERIUM OXIDE COATINGS: In short term, 100-hr tests, it has been shown that a cerium oxide coating significantly reduces the corrosion of ferrite cermet anode substrates. Additional bench tests will be performed with FY 1990 funds. In addition, testing of cerium oxide coatings will be performed in a 6000 ampere pilot cell. Successful completion of this work will allow this project to be considered for funding under the Metals

Initiative program.

HIGH SURFACE AREA ANODES IN LOW TEMPERATURE BATHS: Phase I of this project will be completed in the fourth quarter of 1990. Upon successful completion of Phase I laboratory work, Phase II work will be initiated with FY 1990 funds. In Phase II, testing will be conducted in a 3000 ampere cell.

Question: In sensors and controls, in what industries are you working?

Answer: DOE is working in the following industries: agriculture; aluminum; chemicals; food; foundry; glass; magnesium; pulp and paper; and steel.

Question: Have you developed any sensors or controls that are now being used commercially?

Answer: Yes. An optical humidity sensor for industrial applications has been commercialized recently by Spectral Sciences, Inc. and Pacer Systems. A hygrometer for measuring humidity in harsh drying environments has been commercialized by TransMet Engineering, Inc.; and a pulp and paper industry computer control program was developed by Champion International and is being used to control unit process steps in several paper mills.

Question: What kinds of advances are most needed in this area?

Answer: Sensors most needed at this time are those which can provide real-time, on-line information of processing parameters and product properties. Such sensors are a prerequisite for intelligent process control.

Question: Is there an industrial base with which you work to develop the sensors and controls needed?

Answer: Yes.

Question: If so, who are they?

Answer: DOE works with a cross section of industries and sensor and equipment manufacturers. The industries include steel, aluminum, magnesium, foundry, food, agriculture, pulp and paper, glass and chemicals. DOE works with such associations as the American Iron and Steel Institute; the American Foundrymen's Society; the Glass Packaging Institute; the National Food Processors Association; the American Paper Institute, the Center for Process Analytical Chemistry, and the Institute of Paper Science Technology.

Question: What is the potential energy impact of this kind of technology?

Answer: The opportunities to save energy through the development of sensors and control technology varies from industry to industry and from process step to process step within each industry. In most industries there is an opportunity to save energy in existing process steps by the application of sensors and control technology leading to higher product yields, higher productivity, improved product quality and less waste generation.

In a broader context, sensors and controls are an essential part of intelligent processing systems and also an essential development for the successful implementation of revolutionary, energy efficient processes. Thus the potential impact of sensors and controls technology is significant, with the goal of helping to reduce industrial process energy by 3 percent.

Question: Are special materials needed for sensors?

Answer: The choice of materials of construction for sensors must be made on an individual basis . It is not possible to develop a generic material or class of materials that will be adequate for all applications. In general, sensors are constructed from commercially available materials.

Question: Can they be developed in conjunction with the ceramics program or are other types of materials required?

Answer: It would not be prudent to rely on a single class of materials, for example, ceramics, from which to fabricate sensors. Some sensor applications require material properties for which other materials are uniquely qualified.

Question: How do you determine that the budget level in this area is adequate?

Answer: The budget level in the sensors and controls area is established by comparing the estimated benefit/cost, risk and other program benefits, as well as managerial judgement, with similar benefits and judgements in other program areas. The budget in this area appears to be adequate based on proposals received in response to specific solicitations, the number of unsolicited proposals received, and the backlog of proposals that meet project criteria.

Question: Is there considerable more demand for funds from industry than you are able to provide?

Answer: Recent experience indicates that the level of industry interest in sensors and controls is approximately in balance with the level of appropriated funds; consequently the demand for funds has not significantly exceeded the appropriated funding levels.

Question: What technologies are you pursuing in separations research?

Answer: The following technologies are being pursued in separations research: membrane systems; freeze concentration; distillation; drying, and research and development for the pulp and paper industry.

Question: Who are the major membrane manufacturers in industry?

Answer: The major domestic membrane manufacturers are Dow Chemical, DuPont, Fluid Systems, Millipore, Monsanto Chemical, Union Carbide and W.R. Grace.

Question: In what process areas are membranes used?

Answer: Despite large potential savings in energy associated with membrane technology, membrane systems have not as yet, found wide spread application in industrial processes. Membrane material stability, membrane fouling, selectivity in separating components and capital cost of membrane systems, are problems that inhibited commercialization. However, membranes are used commercially for concentration of some fruit and vegetable juices and dairy products; in the production of chlorine and other industrial gases, such as nitrogen; in the purification of natural gas; in the paper industry for separation process steps; in the production of drinking water and ultra pure water for the electronics industry.

Question: What is the emphasis of your work?

Answer: The emphasis of the membrane research is to develop membrane systems that will displace or supplement the more energy intensive processes, such as distillation and evaporation, and to develop cost-effective membrane systems that can operate in harsh environments. Current research and development activities cover a wide range of gaseous and liquid separations, at temperatures ranging from ambient to several hundred degrees fahrenheit.

Question: How many black liquor projects are you undertaking?

Answer: Four black liquor projects are being funded by DOE. The projects are: black liquor properties; black liquor delivery systems; boiler combustion model; and black liquor gasification.

Question: What energy or environmental benefits are there in recovering black liquor?

Answer: The 1985 Manufacturing Energy Consumption Survey indicated that the pulp and paper industry used 2.6 quadrillion BTU's of energy. Of this energy about 40 percent is derived from black liquor, which is a by-product of the pulping process. Thus, black liquor is an important energy source for the paper industry that must be recovered and utilized efficiently. If the energy from black liquor were not recovered, roughly a quad of energy would have to be obtained from other energy sources. Recovery of the energy from black liquor in the recovery boiler operation also avoids an environmental disposal problem and allows recovery of the chemicals used in the pulping operation.

Question: Describe the projects, including the participants, in which you are involved.

Answer: Black Liquor Properties - The objective of this project is to determine the physical properties, such as viscosity, heat capacity and surface tension, of black liquor derived from a variety of wood species. The work is being performed by the University of Florida. The Institute of Paper Science and Technology is a cost-sharing participant.

Black Liquor Delivery Systems - The objective of this project is to optimize the delivery of black liquor to the recovery boiler, thereby increasing combustion and boiler efficiency. Several nozzles, both experimental and commercial, are being evaluated to determine the best delivery system for the recovery boiler. This work is being conducted at the Institute of

Paper Science and Technology, which is cost-sharing in the project.

Boiler Combustion Model - The objective of the program is to develop a computer model of recovery boilers that burn black liquor, based on data developed in prior and on-going DOE funded programs. The model, when complete, will be used to optimize recovery boiler operation, including design changes. This work is being carried out at the Institute of Paper Science and Technology, which is also cost-sharing in the project.

Black Liquor Gasification - The objective of this project is to gasify black liquor using an indirect heat source and produce a medium BTU fuel that can be used for cogeneration. The program is expected to yield an alternative to the existing Tomlinson Boiler technology. Manufacturing and Technology Conversion International, Inc. is conducting this development, and several paper companies are cost-sharing in the project.

Question: Does the budget allow them to proceed on schedule?

Answer: The FY 1991 request contains $1.5 million for the four black liquor projects as follows:

Black Liquor Properties	$ 350,000
Black Liquor Delivery Systems	350,000
Boiler Combustion Model	300,000
Black Liquor Gasification	485,000
	$1,485,000

Under a cooperative agreement, the next increment of work is negotiated for a 12 month performance period. Negotiation with Manufacturing and Technology Conversion International (MTCI) will be concluded in the fourth quarter of FY 1990.

Question: If not, what funds would be needed to do so?

Answer: We expect to proceed on schedule.

Question: In what applications will drying with superheated steam be used? (p. 332)

Answer: Superheated steam drying with exhaust recompression will have applications for granular and slurry materials in the agricultural, food, chemicals, clay, mining and paper industries. Specific examples are drying of: dehydrated food, prepared animal feeds, beet and cane sugar, rubber and synthetic fibers;

structural clay and gypsum; and bituminous coal.

Industrial Cogeneration

Question: Who is developing the high performance steam generator and steam turbine?

Answer: SOLAR TURBINES is the principal developer. This company is teamed with Inco for the specialty material, Coen for a special burner, and Coppus-Murray will participate in the test operation.

Question: For what kinds and sizes of applications?

Answer: The development is being conducted for equipment that is to be used in cogeneration service. The principles and design features may also be used in utility service but no effort is being expended by DOE in that area. The initial development unit is to be a 4 megawatts (MW) steam turbine installed in conjunction with a gas turbine combined cycle for a total output of approximately 8 MW electrical with a steam flow of up to 100,000 lb/hour. Preliminary design work has been completed using a high performance steam turbine in a combined cycle with a larger gas turbine to give an output of 13 MW. Electric Power Research Institute is also interested in a topping turbine unit of 50 MW capacity to be installed in conjunction with a normal utility turbine, and is investigating this with its own funds. Cogeneration is particularly applicable for high performance steam units in the chemical industry, petroleum refining, as a heat and power supply for a building complex, and for food processing plants.

Question: Who is developing the oxygen-enriched diesel engine?

Answer: The Argonne National Laboratory is conducting engineering studies and exploratory test operations to evaluate the potential performance of the oxygen enriched diesel. The lab is working with and getting assistance from several diesel manufacturers, in particular Caterpillar Diesel.

Question: For what kinds and sizes of applications?

Answer: The technology is primarily for stationary industrial cogeneration service, especially for those applications that require a high electrical output relative to the steam output, (high E/T). The equipment sizes will range from 335 to 4900 KW.

Question: Will this engine emit less particulates than regular diesel engines?

Answer: Yes. This engine will emit a great deal fewer particulates than regular commercial engines. The high oxygen content of the combustion air provides a higher flame temperature to more completely burn the hydrocarbons, which are the principal source of particulates. Actual test data shows a reduction from 460 mg/m_3 with a conventional diesel using ambient air to 50 mg/m_3 with 29% oxygen content in the enriched air. Further reductions are possible with greater enrichment.

Question: What is the status of the coal-fired Brayton testing?

Answer: Test operations have been completed in the fluidized bed facility. Metallurgical testing of the material samples taken from the tubes is under way.

Question: Is the program being terminated or is it complete?

Answer: Facility test operations are complete. Data reduction and metallurgical and performance analysis is under way, and the final report is being prepared.

Question: Was a complete power system built or tested?

Answer: The major component in a Brayton fluidized bed system, the coal fired air heater, was modified and used for conducting the tests. The project did not build a complete power system.

Question: Where is the test facility located?

Answer: In El Segundo, California, at the Rockwell plant.

Question: What are the advantages to this system?

Answer: It provides a high electrical output relative to its thermal output, it burns plentiful domestic fuel (coal), it does not emit large amounts of NO_x, it controls the amount of SO_2 emitted by the limestone used, and it should provide exceptional service life for the turbine. It is one of the very few installations to receive an environmental permit to burn coal in the Los Angeles basin.

Question: In the stationary turbine ceramic work, what is the turbine manufacturer interest?

Answer: There is significant gas turbine manufacturer interest in this program, as it presents an opportunity to capitalize on the performance improvements resulting from ceramic developments. The following manufacturers have indicated their interest:

United Technologies, Turbo Power and Marine
SOLAR Turbines
Allied-Signal (Garrett) -- two separate divisions
Textron-Lycoming
Dresser-Rand
Allison Division of General Motors.

Question: Are Allison and Garrett interested since they are already involved in the mobile turbine program?

Answer: The Garrett Power Division in Arizona and the Garrett Ceramic Division in California have provided written expressions of interest in this program. The Allison Division of General Motors has provided technical information in the preparation of the assessment and program plan.

Question: Please explain what effect the wheeling of power would have on diesel, turbine, or steam turbine design.

Answer: The ability to economically wheel power offers the opportunity for a cogenerator to improve his revenue by increased sales of electricity while continuing to satisfy the industrial process thermal energy demand. For an existing unit, maximum revenue is usually achieved by operating the system close to its capacity. For a new installation the selection of equipment will depend on whether the duty is for "home net" only or whether it will also involve wheeling. If wheeling of power is planned, redundancy features may be added because of the potentially more stressful transient operation which could occur, and also to satisy the reliability requirements imposed by the purchaser.

Question: For what applications are sodium heat engines being developed?

Answer: The principal applications are for electrolytic cells in the chemical process industries. Sodium heat engines produce low voltage, high amperage, direct current (D.C.) electrical power. Such engines operate primarily from waste heat and are more efficient than using high voltage, alternating current, reducing its voltage, and rectifying it to D.C., the current practice in these applications.

Implementation and Deployment

Question: For technology and information transfer please list the seminars and workshops conducted in 1989, and conducted or planned for 1990.

Answer: The following are seminars and workshops held in 1989 and planned for 1990:

Workshop	Date
Held in 1989 and 1990	
Advanced Heat Exchanger Program Review	10/11-12/89
Brayton Cycle Solvent Recovery Conference	10/4-5/89
Composite Initiative Assessment Review	5/31/89
Aluminum R&D Program Review	7/20/89
Advanced Sensor Program Review	10/31/89
Black Liquor Recovery Research Review	11/13-15/89
Industrial Heat Pump Program Review	12/12/89
Advanced Separations Workshop	3/22/90
Chemicals Industry Opportunities Workshop	4/3-4/90
Waste Gas Program Review	5/16/90
Planned for 1990	
Aluminum R&D Program Review	October 90
Industrial Solvent Recycling Conference	October 90
Advanced Sensor Review Meeting	11/12-13/90
Black Liquor Recovery Research Review	December 90

Multi-Sector

Question: In your "Summary of changes" on page 303 for ECUT, almost all areas in materials are being reduced. "Reduce," "scale-back," and "phase-out," are the words used.

Your statement (page 7) says that this work is being picked up in industrial and transportation programs. Explain where, specifically.

Answer: There are several examples of ECUT materials work that has spun off to work being conducted elsewhere in Conservation and Renewable Energy programs. New concepts for materials processing of ceramics through microwave sintering have been extended to the development of silicon nitride ceramic components for gas turbine engines. A magnetohydrodynamic nozzle configuration developed under ECUT could be fundamental to a Metals Initiative project in spray casting of steel. Thermally insulating hollow ceramic spheres (aerospheres) are being incorporated in preliminary evaluations of new refractories for industrial applications. Additionally, funds for the materials work on the Proton Exchange Membrane Catalyst is not being requested in the ECUT FY 1991 budget, but major funding for the PEM fuel cell work is requested under the Energy Storage program under the Energy and Water Appropriation.

Question: Materials work in transportation does not increase in 1991, it decreases (p. 367). Each research and development area in industrial conservation in 1991 decreases. (p. 309). How can the advanced research be being picked up by reduced budgets?

Answer: The FY 1991 request levels for materials related research and development are down slightly from the large amounts appropriated in FY 1990, but still reflect a major commitment to materials research throughout the Conservation and Renewable Energy Budget. In all, over $35 million is requested for materials related research in FY 1991.

Question: Combustion areas concentrating on carbon dioxide emissions and continuous combustion are also reduced. Why?

Answer: The FY 1991 President's budget for continuous combustion research is $1.1 million, compared to $1.2 million for FY 1990. This reduction reflects the completion of a project to develop a one-dimensional prediction computer code for design of gas-fired pulse combustors. Activities are still planned with emphasis on reducing carbon dioxide emissions.

Question: Capital equipment for national labs is reduced. Why?

Answer: The FY 1991 President's budget for capital equipment is $300,000, compared to $593,000 for FY 1990. This amount is believed to be sufficient to provide the capital equipment needed by the program.

ECUT

Question: Explain your relationship with the automobile industry in engine combustion technology work.

Answer: In the Engine Combustion Technology Project, cooperative research working groups are convened two times each year to bring together corporate-sponsored researchers from the automobile industry and DOE-sponsored researchers from national laboratories, universities and private research organizations. This allows continuous dialogue and industry feedback directly to the DOE program to adjust the research agenda and promote technology interchange and transfer of Government-supported research results.

Question: What applications has this work had?

Answer: The goal of the engine combustion technology work is to establish a comprehensive technology base of scientific knowledge and enhanced understanding of the critical chemical and physical processes important in combustion systems and devices. This activity provides industry the means to develop more energy-efficient and environmentally acceptable engines and combustors. The list of applications resulting from this work is long. Most recent applications include the introduction of a specially designed fiber-optically instrumented spark plug for investigating production engine processes without affecting engine operation. This technology is currently being applied at Ford, Chrysler and General Motors. In addition, the engine combustion technology work has produced a computer simulation capability known as the KIVA computer model which has been adopted as an industry standard for investigation of new and advanced engine concepts. Ford, General Motors and Cummins are extensive users of the KIVA model.

Question: Does it assist in fuel economy or environmental goals?

Answer: Yes. For example, work in the engine combustion technology project is underway to assist the automobile and fuels industries in developing two-stroke cycle engines, dilute homogeneous charge engines, and environmentally acceptable diesel engines. Successful development of these concepts will result in engine designs with 10 to 15% fuel economy improvement over conventional technologies. In addition, work is ongoing to provide a comprehensive understanding of the chemical interactions present in engines to support the development of alternative fuel blending strategies motivated by environmental considerations.

Question: Does it assist in engine design or fuel specification?

Answer: Yes. The research in the engine combustion technology project provides the technology for the automobile and fuels industries to design engine concepts using the best available technology. Research with the fuels industry provides the capability to develop blending strategies for environmentally safe fuels and anti-knock additives.

Question: What are the applications for which "spray combustion" is used?

Answer: Spray combustion is used in most industrial furnaces, boilers, and gas turbines. For these applications, a steady stream of fuel is introduced into the combustion chamber. In order for industry to design combustion systems that meet stringent emissions requirements, make extensive use of alternative fuels and improve process quality and efficiency, an enhanced understanding of the spray combustion process is required.

Question: Explain how your work on multiphase flow is critical to CFC replacement research.

Answer: All suggested CFC replacements (with the exception of ammonia in some applications) will result in 7 to 15% reduction in COP (cycle efficiency). This is due to the thermodynamic and heat transfer properties of the replacement materials. The multiphase flow work is focused on developing the technology base for boiling and condensation of mixtures in compact heat exchanger geometries. This technology has the potential to recover the reduction in APE and, in some cases, improve the COPs above current levels.

Question: Please describe your work in superconducting materials development. (p. 391)

Answer: The Research and development on superconducting materials focuses on fabricating "high temperature" superconductors, i.e., those cooled by liquid nitrogen in contrast to helium, for magnets for motors. Initial efforts are investigating two configurations which avoid the conventional wire-wound solenoid; these configurations are a flat plate for an "axial-gap" motor design and bulk ceramics with permanent magnetic fields. A newer and smaller effort examines the effect of processing both organic and inorganic polymers in magnetic fields. The spatial volume of the fields will have to be large and can be generated most cost-effectively with superconducting magnets.

Question: What industrial participation does the program have?

Answer: Industrial participation occurs in two ways: The first is direct collaboration research, e.g., Boeing Aerospace and GTE Laboratories (planned). The second is through various planning groups, e.g., a workshop on superconducting motors is scheduled in July with major U.S. corporations; these include Allied Signal, Reliance Electric, General Electric, Emerson, and Westinghouse, among others.

Question: What progress have you made on developing components and devices using these materials?

Answer: Progress to date on the axial gap motor magnet includes: obtaining a patent on a novel (axial-gap) superconducting motor design, establishing superconducting materials property requirements for midsize industrial motors, and synthesizing and evaluating high temperature superconducting thin films on substrates as needed for this motor.

Progress on the permanent magnets for motors and switches includes: patent disclosure filed on a trapped flux high field magnet, establishing superconduct-ing materials property requirements for the magnet, materials processing to develop favorable microstructure and purity to raise the critical temperature in bismuth-based superconductors to a level of about 110 K where flux stability in devices is assured, and a novel "macrostructure" consisting of alternating superconducting and insulating films; the macrostructure has led to a superconducting current density one thousandfold greater than that measured in bulk or thick film YBCO, the high temperature superconductor most prevalently studied to date, when the material is subjected to a high magnetic field.

Question: In high temperature materials and materials-by-design you are phasing out ceramics work. (p. 394)

Answer: Research and development has been planned for phase-out in both the High Temperature Materials and Materials by Design areas because of higher priority opportunities, specifically those in Corrosion Resistant and Thermally Insulating Materials and in the Waste Minimization part of Materials Processing Technology.

Question: Is the specific work being done somewhere else in the conservation organization?

Answer: Other DOE-CE programs have different objectives for their ceramics work than those for the joining, surface modification, and ultra-tough projects in question. The other programs would use the results of these projects but have not allocated support for these.

Question: Why is work on biobased plastics being reduced? (p. 395)

Answer: Lightweight and Biobased Materials is a very promising area for research and development for energy conservation, environment compatibility, and domestic industrial competitiveness. In particular, the Biobased Materials project has developed and patented a "graft copolymer" approach; this was applied to alloy starch and polystyrene effectively for the first time and could lead to a new technology for producing biodegradable inexpensive packaging plastics. However, in order to exploit the results obtained on the plastics recycling, which is an on-going R&D in this area, and initiate a critical-sized effort on another key opportunity, inorganic polymers, the biobased plastics effort was reduced.

Question: For materials processing by design, is rapid solidification work complete?

Answer: No, the rapid solidification work is not complete. Difficult issues such as controlling porosity and using common commercial atomization practice need to be solved. So far, this project has established the physical mechanism underlying the strengthening observed.

Question: To whom is the technology being transferred?

Answer: This technology is in the process of being transferred to U.S. corporations which need better materials for commercial powder metallurgy products for high-value-added applications. Discussions are on-going with Carpenter Technology, Teledyne Allvac, Special Metals, Universal Cyclops.

Question: What is the status of microwave sintering? (p. 397)

Answer: Microwave sintering of ceramics continues to show great potential and progress. Under DOE-CE support, a commercial composite materials, zirconia-toughened alumina, was sintered to full density with microwaves at a remarkably low temperature, 450 C lower than with conventional radiant heating. This is the type of striking result that will make new alloy design a near- to mid-term reality when coupled to microwave processing. A technical working group with representation from U.S. equipment manufacturers and ceramics manufacturers has been established to further technology transfer on this topic.

Question: What work is necessary to prove the technology?

Answer: An integrated research and development effort is needed addressing three areas - a) ceramics materials design, b) powder synthesis and sintering (and ultimately joining of components), and c) equipment design/modification.

a) Several materials systems need to be investigated, ranging from single phase ceramics to composites. One system would be alumina toughened with various dispersed phases such as zirconia, which has both commercial attractiveness and a range of material- and microstructure-design opportunities.

b) Microwave processing would be examined for flexibility, product yield, and reliability in critical aspects of synthesizing powder (from precursor solutions), sintering powder into shapes of various complexity and size, and joining components in both the green and sintered conditions.

c) Equipment needs should be evaluated to determine practical limits of microwave processing as well as to advance its processing capabilities; this task might include coupling conventional or radiant heating with microwave heating into hybrid systems.

Question: Is this work also funded under advanced materials in the transportation program?

Answer: The microwave processing supported in the DOE-CE-OTT materials program focuses on silicon nitride. This is the material of choice for the ceramic advanced gas turbine engine. The current CE-OTT efforts with microwave processing are nitridation of silicon to silicon nitride and direct sintering; in the latter, the acceleration of sintering has been less dramatic than in the oxide ceramics.

Question: What are the overall funding levels in 1990 and 1991?

Answer: The funding levels in DOE-CE are $1.5 million in FY 1990 and $1.1 million in FY 1991.

Question: Why is the level of support being decreased in 1991?

Answer: On a priority basis, it was decided to reduce the funding in this area and stretch out the project.

Question: Why is work on reinforced silicon carbide composites with industry being closed out in 1991? (p. 397)

Answer: On a priority basis, it was decided to phase-out the funding for this project and discontinue work on the topic.

Question: What has been accomplished to date?

Answer: Important progress has been made on chemical vapor deposition of silicon carbide by each participant - Thermo Electron Technologies Corp. (TECO) and Sandia National Laboratories (SNLL) - in a collaborative industry-DOE Laboratory project. TECO has fabricated fiber toughened ceramic composites, specifically, silicon carbide whiskers or discontinuous filaments in a silicon carbide matrix; these composites have resistance to cracking superior to the unreinforced matrix. This type of gain is needed for effective and reliable ceramic heat exchangers. SNLL has set the stage for modeling the chemical vapor deposition of silicon carbide composites from a multiconstituent gas stream by developing a model for monolithic silicon carbide and by setting up key diagnostics to monitor the multistage deposition process.

Question: Has the work on PEM fuel cell catalyst dispersion been completed? (p. 398)

Answer: No. The work was planned to include the fabrication and evaluation of a new concept for making platinum-based catalysts. The concept involves adapting an ion-exchange process to disperse the active metal tenfold to one hundredfold finer on the substrate. This result could reduce the catalyst cost significantly. The original plan called for completion of this work during FY 1991 and is currently on schedule. At that time any additional work in this area would be supported by the Transportation Program.

Question: If not, why is it not supported in 1991?

Answer: A one-year exploratory research project was envisioned with FY 1990 funding. Based upon the degree of success, a decision would be made as to continuation under DOE-CE-Office of Transportation Technologies.

Question: Why are you phasing out coatings research?

Answer: On a priority basis, it was decided to phase-out the funding for this project and discontinue work on the topic.

Question: Has this research been promising?

Answer: This coatings research and development has been promising, but not as promising as other areas, which is why this research is being deferred. The approach is based on the mineralization process used in nature by bio-organisms. Progress has been made during the initial year of work on organic chemistry associated with two critical steps: a) preparation of the substrate and b) deposition of an organic interlayer which promotes both proper orientation of the major coating material on the substrate and adhesion to it.

Question: What are its applications?

Answer: Coatings that may be developed as a result of this work have a wide range of applications. Three examples are coatings for corrosion-resistant pressure vessels and heat exchangers in the chemical industry, coatings for wear-resistant gears and cutting tools in manufacturing systems, and films for more sensitive sensor elements used in control systems in both manufacturing and product service monitoring.

Question: Why are you phasing out work on conducting polymers? (p. 398)

Answer: The initial phase of conducting polymer research has shown that polymer "self-assembly" in the first monolayer of a film determines subsequent growth of conducting polymeric films. When compared with opportunities in other areas, such as thermally insulating materials, corrosion resistant materials and waste minimization in materials processing, it was decided to phase-out further funding for the polymer project.

Question: A consortium with industry for work in titanium refining is to be established in 1990. (p. 399) Does the work continue in 1991?

Answer: Yes, the work on titanium refining will continue in fiscal year 1991. This project is conducted at the Idaho National engineering Laboratory in conjunction with an industrial consortium and with substantial cost-sharing.

Question: With whom are the national labs doing cooperative research in "catalysis-by-design"?

Answer: Following three workshops with participation from the national labs, industry, and other experts in the field, a national lab/industry initiative was issued seeking proposals to carry out integrated theoretical modeling/experimental verification on "catalysis-by-design." Sixteen proposals have been received from the national labs, and these are currently being evaluated. The proposed industrial partners include most major U.S. oil and chemical companies, as well as several computer and biotechnology companies. It is expected that four of the proposals will be supported with FY 1990 funds, with DOE funds going to the national labs and industry supporting parallel collaborative research in industry facilities with industry funds.

Question: For what kind of processes could your work on carbon dioxide and methane removal from emissions streams be practical?

Answer: The research on removal of carbon dioxide by genetically-engineered algae and other microorganisms and more efficient photobioreactors could lead to methods for use on emissions streams from power plants and industrial sources such as cement plants. Methane could be removed from the emission streams from municipal solid wastes and agricultural wastes.

Tribology

Question: For what specific applications is your tribology work targeted? (p. 401-402)

Answer: The most important application is the characterization of the tribological properties (friction, wear, and lubrication) of ceramic and ceramic composite materials for use in high temperature engines. These new materials do not respond well to conventional lubrication, resulting in unacceptable rates of wear and increased friction (reduced efficiency). It is imperative to assure that engines using a mixture of old and new material technology have a useful economic life at least as great as existing designs. Tribology research is a key element in this pursuit.

Another more specific application of tribology research is the understanding of the physical mechanisms of wear. It is far more economical and productive to be able to create a computer simulation of engine sub-systems than to build and test prototypes to destruction. However, the computer model must have within it all the salient characteristics of the materials in question. This knowledge is being gained in the DOE National Laboratories where the theoretical and physical characteristics of new materials are being studied. The goal is to be able to predict failure mechanisms which are responsible for determining the useful life of mechanical components such as cylinder liners, valve faces, and pushrod assemblies. Engineers subsequently use this failure data to optimize engine designs. Modeling is being conducted by Argonne National Laboratory, National Institute of Science and Technology, and through a consulting agreement with Cambridge University, England.

Question: If emissions controls became more strict, what can be done to engine oils and lubricants to lower emissions?

Answer: The most promising avenue for control of emissions due to oil and lubricants is to prevent their escape from the engine. Engine "blowby" in the combustion chamber and poor bearing seals are two major routes for contamination of the environment.

Conventional mineral lubricating oils used in diesel engines are known to contribute an average of 25 percent to particulate emissions. New high temperature synthetic liquid lube oils have the potential for reducing this contribution by 70 percent. In addition, high temperature liquid lubricants allow repositioning of top piston rings closer to the head land with attendant fuel contribution emission reduction of 5 to 10 percent.

Question: Who is doing work in this area?

Answer: CompuTec Engineering, under contract to DOE, has developed a computer code which is being evaluated by Ford Motor Company. This code adjusts the design of cylinder walls and piston rings to minimize the out-of-roundness which accounts for oil escaping into the combustion chamber and resultant emission problems. Burton Industries, under contract to DOE, has developed a proprietary glassy carbon material that is a candidate for improved seals and bearings.

High temperature liquid lubricant work is being conducted under the Heavy Duty Transport Program by Cummins Engine Co. and AKZO.

Question: Can the same lubricants be used with alternative fuels as with gasoline and diesel burning engines?

Answer: Conventional lubricants have been demonstrated to operate successfully with alternative-fueled engines. However, additive packages have been developed for specific fuel properties, e.g., methanol. Fleet experience, such as the Federal methanol fleet, is providing valuable information in the further refinement of special oil packages which may be necessary to further mitigate wear effects attributed to cold weather operation with methanol.

ECUT

Question: If funding were available for ECUT at fiscal year 1990 presequestration levels, in what areas would you allocate the funds?

Answer: The FY 1991 budget request for Energy Conversion and Utilization Technologies was $22,900,000 compared to an FY 1990 presequestration level of $27,300,000. If an additional $4,400,000 were made available, it could be applied to the following activities:

	($ in thousands) Funding	Cumulative
FY 1991 Request	$22,900	$ 22,900
Supercritical Combustion/ Waste Combustion Incineration	+1,000	23,900
Non-CFC and High Temperature Insulating Materials	+ 400	24,300
Tribology	+1,000	25,300
Thermal Sciences	+1,000	26,300
Biocatalysis/Catalysis	+1,000	27,300
Total	$27,300	

International Research Monitoring

Question: Explain to what uses the information you gather in international monitoring are put.

Answer: Information from international science and technology monitoring efforts is used by Conservation programs in two ways: to help establish technical directions for current or future research and development (R&D) programs, and to evaluate opportunities for international R&D collaboration. For example, the technical content of DOE energy efficiency R&D supporting the steel industry benefited from an International Research Monitoring (IRM) study of metals processing R&D in Western Europe. In a second example, recent concern regarding international CFC emissions has stimulated DOE R&D efforts in this area, and the IRM program provided relevant information on foreign developments to help shape the U.S. program.

International science and technology collaboration has also been an important application of information from the IRM program. Collaborative efforts are sometimes entered into to help keep the costs of U.S. R&D down.

Question: For the entire conservation program, please provide a listing of international cooperative research, and funding for each project, for 1990 and 1991.

Answer: The two attached tables provide the requested information.

INTERNATIONAL ENERGY AGENCY (IEA)

IMPLEMENTING AGREEMENTS

NAME OF AGREEMENT	MULTI-NATIONAL PARTICIPATION	SYNOPSIS	U.S. FISCAL YEAR DOLLARS	U.S. % OF FUNDING
High Temperature Material for Automotive Engines	* G, US	Research to improve the efficiency of automotive engines through the use of ceramics and other advanced materials.	1990: Task Shared ** 1991: Task Shared **	
Alcohol and Alcohol Blends as Motor Fuel	* C, D, F, I, J, NE, NZ, NO, SWE, SWI, UK, US	RD&D of alcohol fuels as substitutes for petroleum based fuels	1990: $58,000 1991: $58,000	31.5% 31.5%
Pulp and Paper Industry	* B, C, D, J, NE, NZ, NO, SE, SWI, UK, US,	Focused towards improved drying efficiency, electrical self-sufficiency and generation, and sludge dewatering in the pulp and paper industry.	1990: Task Shared ** 1991: $60,000	15.4% 15.4%
Center for Analysis and Dissemination of Demonstrated Energy Technologies (CADDET)	* AU, C, D, F, GR, NE, NZ, NO, SWE, SWI, UK, US, J	To broaden and improve the collection and exchange of information on demonstrated energy efficient technologies in the end-use sector.	1990: $155,000 1991: $155,000	11% 11%
Combustion Processes	* I, NO, SWE, UK, US	Accelerate development of new, efficient combustion equipment for engines and furnaces.	1990: Task Shared ** 1991: Task Shared **	

Heat Transfer and Heat Exchangers	* NE, SWE, SWI, UK, US	Improvement of thermohydraulic design and performance of heat transfer equipment, optimal design of heat exchanger networks, and improved structural design and reliability of heat transfer equipment.	1990: 1991:	Task Shared ** Task Shared **	
Advanced Heat Pump Technology	* A, B, C, D, G, I, J, NE, SWE, US	Research advanced heat pump alternatives working fluid, thermal storage, and related technologies.	1990: 1991:	$197,000 $197,000	13.1% 13.1%
Buildings and Community Systems	* AU, B, C, D, G, I, NE, NZ, NO, SWE, SWI, T, UK, US	Research advanced building technologies related to energy managment, airflow and ventilation, structural, and related technologies.	1990: 1991:	$384,000 *** $384,000 ***	25.6% 25.6%
District Heating	* B, C, G, I, NE, SWE US	Provides research and information exchange regarding energy conservation and increased fuel flexibility through district heating.	1990: 1991:	$80,000 *** $80,000 ***	24% 24%
Energy Storage	* G, NE, SWE, SWI, CEC	Research means of large-scale thermal storage, primarily related to use of aquifers.	1990: 1991:	Task shared ** Task shared **	

***   GUIDE TO ABBREVIATIONS ATTACHED.**

****   INFORMATION IS SUPPLIED RATHER THAN FUNDING.**

*****   EXISTING IMPLEMENTING AGREEMENT WITH IEA STRUCTURE. U.S. PARTICIPATION, BOTH INDUSTRY AND GOVERNMENT, UNDER CONSIDERATION.**

Guide to abbreviations used in list of International Energy Agency Agreements.

A--Austria
AU--Australia
B--Belgium
C--Canada
D--Denmark
F--Finland
G--Germany
GR--Greece
I--Italy
J--Japan
NE--The Netherlands
NZ--New Zealand
NO--Norway
SP--Spain
SWE--Sweden
SWI--Switzerland
T--Turkey
UK--United Kingdom
US--United States
CEC--Commission of European Communities

BILATERAL AGREEMENTS

BILATERAL AGREEMENTS	DOE PROGRAM AREA
Israel	Energy Storage
Spain	Vehicle Propulsion R&D
South Korea	Broad Areas of Conservation
Canada	Alternative Fuels Utilization
Venezuela	Office of Building Technologies
Austrialia	Alternative Fuels Utilization
United Kingdom	Solid Wastes Utilization and Conversion Membrane Technology Development

Bilateral agreements involve no specific funding. All agreements are limited to task-sharing and data exchange.

Program Analysis and Planning

Question: Most of the funding for program analysis is for two national laboratories. (p. 407) Why?

Answer: The two national laboratories funded for program analysis are the Oak Ridge National Laboratory (ORNL) and the Pacific Northwest Laboratory (PNL). ORNL provides analytic support in the area of technology transfer. For example, ORNL produced a report in 1988, "Technology Transfer Strategies of the U.S. Department of Energy's Conservation Program," which documented the processes used to generate private sector interest and involvement in the Conservation program's activities.

PNL provides support in the area of macroeconomic analysis, an example of which can be seen in the development of the 1989 DOE report "Energy Conservation Trends, Understanding the Factors that Affect Conservation Gains in the U.S. Economy." PNL provided the technical analysis upon which this report is based.

The support provided by both national laboratories complement each other and the Conservation Program.

Question: In addition, Energetics is also contracted to do this work (p. 408) What is the dollar value of the Energetics work in 1990 and 1991?

Answer: During FY 1990, the final option year on the Energetics contract was exercised, and $280,000 was authorized. No funds will be provided in FY 1991.

Question: What are Energetics' qualifications to do program planning and analysis?

Answer: Energetics was selected to provide support services, for the former Office of the Deputy Assistant Secretary for Conservation, on the basis of a competitive procurement action. A contract for one year, with four option years, was signed between DOE and Energetics on April 7, 1986. The contract is now in its fourth option year and will expire in April 1991. Their qualifications include extensive background and experience in operations research; ability to quickly conduct literature searches and investigations on various subjects; and knowledge of industrial processes, practices and trends.

Energetics, Inc. provides general analytic support, including data gathering for strategy development; regulatory analysis; acquisition and integration of technical and economic data on potential R&D opportunities; and planning coordination and integration. Their activities are limited to providing background analyses on issues and topics of interest to the Deputy Assistant Secretary, such as analysis of engineering data and assessments of private sector interest in ongoing and proposed R&D activities. They do not do program planning or management.

Question: What other contract work does Energetics do for you and for what purposes?

Answer: Energetics, Inc. provides general and technical support to the former Offices of Buildings and Community Systems and Industrial Programs, and to the former Division of Energy Conversion and Utilization Technologies. Each of these contracts was awarded as the result of a competitive procurement.

Technology Assessment and Transfer

Question: Why do you cut funding for disseminating ECUT research results in 1991? (p.415)

Answer: Sufficient funds were available from FY 1990 to allow publication of the ECUT bulletin with no additional funds requested in FY 1991.

Muti Sector - Inventions and Innovations

Question: Why are less evaluations of inventions planned in 1991 than in 1990? (p. 410)

Answer: The number of invention disclosures received at the National Institute of Standards and Technology (NIST) has been declining over the past 4 years. Based on their statistics we estimate that about 1000 disclosures will be received during FY 1990.

Question: Do you expect to receive less responses?

Answer: That depends on the success of the recent efforts on the part of NIST to increase their outreach activities. While the current trend of invention disclosures shows a decline in the number, NIST has been attempting to be more aggressive in reaching inventors and small businesses that could be interested in participating in the Energy-Related Inventions Program. That could lead to an increase in the number of disclosures received at NIST.

Question: Why are there six National Innovation Workshops in 1991 versus three in 1990? (p. 410)

Answer: Historically, DOE has provided funding to NIST to conduct six National Innovation Workshops (NIW's) per year. There will be six NIW's in both FY 1990 and FY 1991. This number has been obscured by the fact that three NIW's are being run by NIST in the "Inventions Evaluations" line of the budget for FY 1990, and three are being run by DOE in the "Inventor Assistance" line. In FY 1991 DOE will take over the management of this program as part of the increased emphasis on technology transfer and program outreach under the new Conservation and Renewable Energy organization.

Question: How was Virginia Tech chosen to participate in this process?

Answer: Virginia Polytechnic Institute and State University (Virginia Tech) has been associated with a related series of educational workshops, called Commercialization Planning Workshops (CPW's), for several years. These are held specifically to educate inventors which NIST has recommended to DOE for technical and/or financial assistance. It is a natural extension of Virginia Tech's educational experience with CPW's to include assistance with the NIW series.

Question: For innovative concepts, the procurement cycle is extended to 18 months in 1991 from 15 months in 1990. (p. 410) Why?

Answer: The program has historically operated on an 18-month cycle. Each cycle has been funded with about a year-and-a-half's worth of funds. The increase in funding in FY 1990 initially prompted the Department to consider switching to a 15-month cycle, but that has not been set yet. The program may in fact be better off by keeping its traditional schedule, and using the additional funds in FY 1990 to support additional grants and a program evaluation. The FY 1991 request assumes that the traditional cycle will be maintained.

Question: What would it cost to keep the program on a 15 month cycle?

Answer: The cycle length and program funding are not inextricably linked. A 15-month cycle could be maintained at virtually any funding level, but fund reserves would be less than in an 18-month cycle (assuming the same annual appropriation).

Question: What have been the results of the procurements to date? How is this program different from the SBIR program?

Answer: The track record of the Innovative Concepts Program has far exceeded the original expectations that at least 1 concept in 10 would receive follow-on funding from another sponsor. As of March 1990, 15 of the 32 innovators funded by seed money of $15,000-20,000 from this program during the first three procurement cycles have received more than $9 million in follow-on funding from other sponsors. Almost 45 percent of this follow-on funding has been from non-Federal sources, such as the Institute for Gas Technology, the Gas Research Institute, Baltimore Air Corp., Sara Lee, and the Amax Foundation. In addition, 2 companies have been started, 9 patents have been issued, 7 patents are pending, and many masters theses and more than 50 journal articles have been written on these concepts. Six concepts have been recommended to DOE by NIST because we encourage these innovators to apply to the Energy-Related Inventions Program for additional support. Although it is too early to judge the results of the October 1989 technology transfer meeting, one innovator from that most recent procurement cycle has already received $100,000 in follow-on funding.

The attached chart provides some additional insight into the differences and similarities between the SBIR and the Innovative Concepts Program. The major difference is in the size of awards, the frequency of the procurement cycle, and the target audience. SBIR can award up to $550,000 in two phases, while Innovative Concepts provides only $15,000-20,000 in one-time only funding. SBIR is required by law at 11 different agencies and is funded by a 1-1/4 percent tax on all extramural research. The Innovative Concepts Program is funded only in the Energy Conservation appropriation and targets topics of specific interest to the Conservation and Renewable Energy programs.

Technology Assessment and Transfer

Question: Why do you cut funding for disseminating ECUT research results in 1991? (p.415)

Answer: Sufficient funds were available from FY 1990 to allow publication of the ECUT bulletin with no additional funds requested in FY 1991.

Question: What demonstration of oil and gas inventions is planned in 1991? (p. 415)

Answer: We plan to assemble a team of State, local, and private sector organizations who are interested in observing actual field demonstrations of the four dozen or so "oil patch" inventions that have been funded by the Energy-Related Inventions Program. The demonstration will be conducted at a site to be determined where actual operating conditions can be used and industry standards can be met. Because these inventors perceive that their largest stumbling block to overcome is the lack of opportunity to promote their technologies, we view this demonstration project as a serious, difficult pilot project that must be carefully thought out, researched, and arranged. Oak Ridge National Laboratory is assisting us by conducting an evaluation of how open the oil and gas industry is to licensing technologies from small businesses and individual inventors. We then expect to determine the threshold of their interest. By the end of 1991, when all these pieces have been assembled, we will then conduct the field demonstration of oil and gas inventions.

Facilities

Question: Please explain why construction of an addition to the Combustion Research Facility is included in your budget when the facility is under the control of the Office of Energy Research.

Answer: Approximately 25% of the support for research at the Combustion Research Facility (CRF) comes from the Conservation R&D (CE) program and it is anticipated that the expansion of the CRF will provide added benefit to the research underway for CE. The CRF has been essential to the progress achieved thus far in CE engine combustion research.

Question: How much funding has been provided for the facility addition so far?

Answer: To date, the Congress appropriated a total of $4.8 million for the facility addition.

Question: If only previous funding is provided, what will have been completed in the facility?

Answer: The previous funding has been used to complete the facility design and initiate construction. To date, approximately 25% of the facility has been completed. Essentially the site has been prepared and the shell of the laboratory building has been completed.

Question: What does the additional $4 million pay for?

Answer: The additional funding will be used to continue construction of the facility. The OMB passback indicated that the remaining funds necessary for completion will be requested in FY 1992.

Question: With the additional $4 million will the building be of any use?

Answer: No. Construction would not be completed to a useable condition. Since the FY 1991 request was not intended to be the final request, it was not intended to complete the facility. It will get construction back on track, with the remaining funding to be requested in FY 1992. This funding pattern is intended to be consistent with other construction applications, and with other CE requests, such as the $4.5M currently being requested in the Energy & Water Appropriation to begin a new building at SERI.

Question: Do you intend to request the required funds to complete the project?

Answer: The Department expects to request the remaining funds in the FY 1992 budget.

Question: How much additional funding is necessary?

Answer: After the $4 million in FY 1991, it is estimated that $12.8 million will be required to complete the addition. The estimate includes almost $6M in instrumentation.

Question: Does the Office of Energy Research intend to continue to operate the expanded facility?

Answer: Yes. It is expected that Energy Research will continue to operate the CRF including the Phase II facilities when they are completed.

Question: What evidence is there of support for its expansions?

Answer: The expansion of the Combustion Research Facility has been widely endorsed by the scientific community, having been reviewed often, with favorable results. The level of industry activity at the lab is also strong evidence of support. Each year the CRF hosts about 300 industry and 400 university visitors for short-term technical exchanges, plus about 13 industry and 50 university long-term visiting researchers.

Question: Is it expected that programs under your control will benefit from the use of the expanded facility?

Answer: Yes. The research in the CE's combustion technology research programs will advance because of the new CRF capability. With the new facility, the CE programs will have new laser diagnostic capabilities and will be able to accommodate more visiting industry researchers to enhance technology transfer.

Question: How will they do that?

Answer: In addition to gaining improved access to the CRF capability now in secure areas, the expansion will support increased outreach to the U.S. industry, and will include facilities to study critical areas such as alternative fuels combustion, CO2 production and other global effects. The expansion includes a doubling of present laboratory space, next generation laser-based instrumentation and increased supercomputer access. These capabilities are used extensively by the research staff at Sandia and by visiting industry and university researchers to investigate combustion and related processes important to the development of energy-efficient, environmentally acceptable technologies.

Question: Can they do that if only the currently requested $4 million is provided?

Answer: No. The currently requested $4 million is not sufficient to complete the full realm of planned activities. The same can be said of partial funding for any research facility.

Building Materials

Question: What work are you doing on non-CFC insulation?

Answer: The program has a two path approach to non-CFC insulation development. The first, and most urgent, is to assist the foam insulation industry in the development of non-CFC gases as drop-in replacements for the current CFC foaming agents. However, these alternative foaming agents also have an ozone depletion potential. Hence, the second path is to develop new non-ozone-depletion insulation materials to eventually replace the new foam products.

The program is supporting the foam insulation industry in a joint, 50/50/cost-shared/project with the industry and EPA for the development of non-CFC foaming agents, the calibration of test equipment commonly used by the industry, and the development of additives to foam insulations that will mitigate the inferior performance of the alternative foaming agents.

There are currently two active projects (evacuated powder panel and compact vacuum insulation) for the development of alternative vacuum or super insulations as candidates for the replacement of foam insulations. The FY 1991 research program will initiate at least one new candidate insulation project from several proposed, that is targeted to replace foam insulation in refrigeration equipment.

Question: Are you developing any materials or only providing testing support?

Answer: Historically, program activities have addressed both areas, but focused primarily on testing support for the development of standard test procedures, and the characterization of existing insulating materials - all valuable activities supported by the industry.

Recent energy savings assessments have shown that the heating, cooling and equipment energy consumption of buildings can be potentially reduced by 30 percent with the development of cost effective super insulations and dynamic materials that control the flow of heat through the building envelope. This opportunity to significantly increase building energy efficiency is too promising to ignore. A new program focus initiated this year is to place greater emphasis on the cooperative development with industry of advanced material concepts targeted at both new and retrofit applications. The current materials development activities are investigating replacements for CFCs in foam insulation, evacuated powder panels and compact vacuum insulations.

Question: What are switchable emittance coatings and what is their significance?

Answer: Switchable emittance coatings or films are materials that have the ability to change the amount of radiant heat that they absorb or reflect. The emittance can be changed by an electric current, temperature variations, or other means. Recent energy saving assessments have shown that switchable coatings or films can reduce the heating and cooling energy use in buildings by 20 percent.

A building lives in a dynamic environment with daily and seasonal temperatures changes. To reduce energy use, the building envelope must be dynamic to utilize these changes in the most advantageous manner. Switchable emittance coatings may provide the means needed for this dynamic interaction.

Question: Explain vacuum insulation and your work in that area.

Answer: All conventional insulating materials have three modes of heat loss: conduction, convection and radiation. Vacuum insulation eliminates the first two modes, leaving radiation as the only significant mode of heat transfer. If the two sides of a vacuum panel are highly reflective, then the radiative loss is greatly reduced, as in a thermos bottle. With vacuum insulation, R-values in excess of 100 per inch are theoretically achievable.

The program is currently supporting two vacuum insulation concepts, evacuated powder panel and compact vacuum insulation. The evacuated powder panel is a slab of common powder encased in a flexible film with a soft vacuum drawn on the interior. Compact vacuum insulation consists of two thin metal sheets welded together along the edges. A matrix of small glass spheres separates the sheets and a hard vacuum is drawn on the inside. Both projects have demonstrated proof of concept and have been tested in refrigeration applications. R-values in the range of 20 to 25 per inch have been achieved.

Question: How practical is this concept (vacuum insulation)?

Answer: This concept is very practical. Proof of concept has been demonstrated, and vacuum insulations have been successfully tested in real applications. The remaining issues to be addressed are: improved thermal performance, durability, cost effectiveness and fabrication techniques.

Building Subsystems

Question: Explain your work on moisture mitigation in energy efficient buildings.

Answer: DOE currently supports two research areas which address moisture control and mitigation in buildings. The first is a major research and development effort on moisture transport phenomena and humidity control in buildings being performed by the Florida Solar Energy Center (FSEC). This research should result in the technical knowledge that can help reduce cooling and dehumidification loads.

The second area of research, directed by Oak Ridge National Laboratory (ORNL), addresses moisture control and mitigation in energy efficient residences. This research, addressing the building envelope (wall, roof, and foundation), is closely coordinated with the National Institute of Standards and Technology, USDA's Forest Products Laboratory, HUD, several universities, and Canada's National Research Center. One near-term output of ORNL's research will be a Moisture Control Handbook for Residences.

Question: The hotel industry evidently has a severe moisture problem. Are you aware of this problem? Do you have information or resources that can assist the industry in solving this problem? If so, how long would it take to design a program and how much would it cost?

Answer: The American Hotel and Motel Association's (AHMA) Executive Engineering Committee has brought to the attention of DOE its severe moisture problem. Moisture problems in hotels and motels, particularly in the Southeastern United States, pose a significant financial burden on the hotel industry in terms of increased energy costs, lost guest revenues, and repair of moisture damages. DOE has agreed to provide technical assistance to support an AHMA research project addressing moisture control in hotels and motels. We believe this work not only benefits the hotel industry sector but is also directly applicable to moisture control in energy efficient affordable senior and multifamily housing.

Question: How was the University of Minnesota Foundation Test Facility funded.

Answer: The facility was funded by a number of sources. These include oil overcharge funds returned to the State of Minnesota. They also include funds from the Society for Plastics Industry, Polystyrene Division. Some funds for special instrumentation to enable close correlation of test results were provided by DOE.

Question: What was the cost of this facility?

Answer: The original estimate for the first four basement test houses was $100,000. This was for construction only and did not include the cost of the data acquisition hardware or software. Since part of the facility is still under development, the Underground Space Center of the University of Minnesota does not have the final costs. They said they would be glad to discuss this matter with the Committee.

Question: Why are two sites needed?

Answer: Multiple sites are needed to provide data for different climatic zones and different soil conditions. Also, multiple sites are needed to provide confidence in the experimental data.

Computer modeling results suggest that foundation insulation is justified in all parts of the U.S. Models have not been extensively validated, particularly in climates with both substantial heating and cooling seasons. These facilities are used primarily to validate computer models and to provide measured data to confirm foundation insulation effectiveness. Issues relating to builder and code official acceptance differ between northern climates like Minnesota and more temperate climates like Oak Ridge. In temperate climates, the norm for foundation insulation is none. The South has termites--a problem which affects foundation design. The South also has a longer cooling season, which results in different moisture problems. There are numerous other differences which demand multiple sites.

Finally, since few foundation systems have been insulated (about 5%), and since about 25% of the heating and cooling losses in a building are through the foundation, the potential energy savings from new energy efficient foundation materials and systems are significant (about 1/2 Quad per year). Achieving these savings will require foundation systems effective in all climatic zones.

Question: How are the two sites different?

Answer: The Oak Ridge Site is being used for roof, wall and foundations system performance. This site is funded partially by private industry dollars. The roof is part of a $600.000 research program to develop alternative HCFC blowing agents for rigid laminate insulation board stock. Both DOE and EPA are funding a portion of the Oak Ridge facility. There are certain differences in the design of the experiments and HVAC capabilities. However, in the area of instrumentation and sensors, care has been taken to assure the ability to correlate data.

Windows and Daylighting

Question: In windows research, does the 1991 budget include funding for the development of a window labeling program? If so, how much? How much was included in 1990?

Answer: In FY 1991, there are no direct funds for "window labeling"; however, about 70 percent of the program has some impact on window rating and labeling research. The total indirect FY 1991 funding may amount to about $500K. Direct funding for window labeling in FY 1990 was approximately $100K and indirect funding for FY 1990 was probably about $550K.

Question: If so, how much?

Answer: Since about 70 percent of the windows research program has some impact on window rating and labeling research, the total indirect FY 1991 funding for labeling may amount to about $500K.

Question: How much was included in 1990?

Answer: direct funding for window labeling in Fy 1990 was approximately $100K and indirect funding for fy 1990 was probably about $550K.

Question: What are the benefits of [window] labeling?

Answer: A national rating and labeling program which provides accurate and accessible information about window performance would promote the selection and use by builders, architects and homeowners of more energy efficient windows. A number of States and utilities are already adopting window labeling programs. A labeling program can also promote investment in new window technologies. There are increasing industry demands for a credible rating system which is capable of differentiating superwindow technologies. The ability to differentiate such products in the marketplace, though technically difficult, is needed by industry to justify continued research investments in superwindows and other advanced concepts.

Question: What is industry's response to the [window labeling] concept?

Answer: Industry response to the labeling concept initially was mixed. However, a number of factors has resulted in a change in industry opinion. These factors include: the decision by several States and Canadian Provinces (affecting U.S. companies under the Free Trade Agreement) to mandate labels; and utility incentive programs which provide incentives for windows rated as higher performing. Industry is concerned about having to respond to a large number of different State and utility rating systems.

The window industry also is interested in eliminating consumer confusion resulting from inaccurate and inconsistent product performance claims. Window manufacturers have been conducting research to adopt the DOE/LBL-developed superwindow technology into their product lines. Before making major investments in further research and in the introduction and widespread marketing of such advanced concepts, a rating system capable of differentiating such products is needed.

All these factors led to the recent establishment of the National Fenestration Rating Council (NFRC) to promote a uniform, accurate and credible window energy rating system. NFRC is a broad coalition representing all major elements of the window and glass industries, as well as the building, design and utility industries, public interest groups, and States. Industry is now strongly behind a window labeling program. They are now working with DOE to develop the technical basis for such a program, and are interested in accelerating the national effort because of State, utility and new product requirements.

Question: In windows research, how much is included for "superwindows"?

Answer: Approximately $100K of direct DOE funding was provided in FY 1990. The cost share from industry and utilities exceeds 50%. Direct funding in FY 1991 is reduced. Indirect support from other areas of the window research program are contributing to Superwindow Technology. For example, we are developing the capability to evaluate and compare high performance windows as part of fenestration performance research activity which directly supports window labeling. Also, we are improving the Mobile Window Thermal Test (MoWiTT) facility to evaluate the energy impact of Superwindows and other advanced concepts on whole building performance.

Question: What is the status of this development?

Answer: This program was started in FY 1986. Results to date include: DOE/utility field test of three superwindow prototypes at the Mobile Window Thermal Test (MoWiTT) facility and also in Montana residences, and lab testing in the highly accurate NRC Canada hot box. Side by side field tests in MoWiTT with an R-19 wall under winter conditions proved that the net daily energy performance of a superwindow was superior -- even facing north because of the heat gain through the window. This year we are initiating a user facility at LBL to aid industry in their development of superwindow frames. In 1990, the first commercially available superwindow glazing was introduced; however, a complete superwindow system design with improved edge and frame is not yet available.

Question: What is industry's interest?

Answer: Superwindows are a logical extension to the market development of low-E windows systems, one of the most successful new products in building history, now capturing over 30% of residential window sales. Interest by industry has been strong in this highly leveraged superwindow program. In fact, industry and utilities have expressed strong interest in expanding the cooperative project to involve more extensive field and laboratory testing, involvement of the National Association of Homebuilders, and other user organizations. The object would be to resolve a number of user and technical requirements in upgrading these pre-production prototypes, based on DOE/LBL technology, which were developed by the various manufacturers; and to prepare for widespread adoption of the technology. Also, the National Association of Homebuilders in its Advanced Technology Application Program has rated superwindow development as one of the most important future developments.

Question: What is the benefit of the technology?

Answer: Superwindows have such a high performance level that they outperform highly insulated walls. If labels provide accurate information to consumers comparing window performance, we expect that superwindows will significantly shift the average window performance to a R-5 or greater level. The energy benefits would then exceed two quads if superwindows were used in 80% of the buildings in cold climates. Development of Superwindows would encourage selection of window size and location to meet human needs for view and productivity, rather than minimizing window area, as is now the practice for some existing window technologies. These windows improve comfort and reduce or eliminate condensation, which can result in dry rot and high maintenance costs.

Question: In windows research, explain what activities will decrease with a reduction of about $400,000 in 1991.

Answer: Reductions will be made in the advanced optical technologies and the building applications areas. Window performance research will be reduced to a lesser extent because of the priority for window labeling research support. The impact of the reductions will be a delay in the development of window labeling of about one year from our previous schedule and about 3 years from what States and utilities were proposing. Superwindow technology funding will be reduced, although industry may make up the difference. Development of the design tools to make the thermal and optical properties useful to builders and architects would be delayed.

Question: How does daylighting research relate to windows research?

Answer: The "Daylighting Research" activity is basically the daylighting materials research and systems integration activity which was previously listed under "Solar Building Technologies". The "Windows Research" activity is basically the "Windows and Daylighting Research" activity which was previously listed under Building Subsystems. Taken together, these efforts cover most of the important window related technologies and systems. Since both programs have used the Windows and Daylighting Group at LBL as their Lead Technical Center, the projects have been fully coordinated.

Question: Can the coatings and optical switching capabilities be integrated with the "superwindow" work, for example?

Answer: Elements of these two project areas are already integrated. For example, building modeling to determine the performance of each of these technologies is carried out using the same software and building description so that the results are comparable. It is probable that the optical switching and "superwindow" technologies can be integrated technically.

However, the issue to be addressed is: in what building applications and climates would one want to combine optical switching film and "superwindow" technologies? Optical switching films are designed to dynamically control the solar resource in response to cooling and daylighting requirements, particularly in buildings located in Southern climates. Superwindows are designed with double low-E coatings and special gas fills to reduce heat loss through the envelope of buildings whose thermal performance is more influenced by heat losses through the envelope, as in residential structures and in buildings in Northern climates.

Question: Explain the "core daylighting" concept.

Answer: Core daylighting is used to provide daylight deeper into the "core" of buildings into areas that do not have easy access to windows or skylights. These systems usually consist of a tracking (mechanical or dynamic holographic) sunlight collector and a guide to distribute the light at needed locations. There must also be a means to control electric lights to provide adequate light when the sun is not shining.

Question: What is a holographic coating?

Answer: Holographic films are part of a class of optical films being considered to control and redirect sunlight from anywhere in the sun's path to a desired location inside the building without the use of moving parts. Holograms are diffraction coatings which are created by exposing a photographic plate to a laser beam or by etching a microscopic diffraction pattern directly in the coating. Holographic films may be used in the upper portion of windows to direct daylight deep into the room. These films can also be coupled with liquid crystal coatings to provide a dynamic holographic tracker for collecting daylight for core daylighting applications.

Question: What is industry's involvement in the daylighting program?

Answer: Industry is involved in all aspects of the daylighting research program. For example, industry participates in program planning, in the research itself through contracts and cooperative arrangements with DOE laboratories, in technical and progress reviews throughout the research process, in the establishment of appropriate performance parameters and test procedures, and in the design of performance tests.

Question: Explain what activities will decrease as a result of a reduction of $435,000 in daylighting in 1991.

Answer: Work on the electrochromic optical switching window coatings will be slowed down.

Indoor Air Quality

Question: In indoor air quality, what organic compounds do you intend to monitor?

Answer: Field studies at both Lawrence Berkeley Laboratory and the National Institute of Standards and Technology include measurements of various organic compounds which are typically the subject of current indoor air quality investigations. These compounds include carbon monoxide, nitrogen oxides, and total volatile organic compounds. In addition, DOE research supports efforts to develop advanced measurement techniques that would allow for more complete understanding of IAQ in buildings. In 1991, this latter effort would include the development of a passive sampler for carbon monoxide and the initiation of the development of measurement methods for specific volatile compounds which are known irritants.

Question: Explain the industry consortium you intend to develop and what its function will be?

Answer: Capabilities in laboratory experimentation have been under development at the Solar Energy Research Institute with the support of DOE's research program on indoor air quality, infiltration and ventilation. The capabilities include small-scale and full-scale facilities designed to model air flow characteristics within a room. The HVAC industry has been invited to consider uses for these facilities. A project on cold air distribution has been identified by the Electric Power Research Institute as a likely project to use these facilities in the next year or so.

Question: On an overall basis, what progress has been made in the indoor air quality area?

Answer: Although considerable knowledge has been gained since the recent emergence of the IAQ issue, there still remains a considerable lack of definitive solutions. a possible exception is radon, where our technical knowledge concerning sources and mitigation has progressed to the point that the remediation work is proceeding. However, uncertainty continues concerning the actual health risk associated with radon.

Question: Have any steps been taken to improve air quality?

Answer: In addition to the general increase in information available to the public on IAQ, the most significant steps to improve indoor air quality have been those taken by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). ASHRAE has recently issued an update of a standard entitled "Ventilation for Indoor Air Quality." Adoption of this standard will result in general improvement of IAQ in new construction. DOE's research results contributed to the development of this standard. Other standards now being developed by ASHRAE will also have a positive effect on IAQ, i.e., "Effective Ventilation" and "Residential Ventilation." DOE works closely with ASHRAE on these developments.

Subsystems Interaction

Question: What is the status of the Advanced Energy Design and Operations Technologies (AEDOT) program?

Answer: The AEDOT program is currently beginning development of its first prototype. Work on this prototype will begin to establish the links necessary to ultimately develop an integrated system by integrating one existing computer-aided design (CAD) package into the prototype, collaborating with other researchers to achieve leverage of knowledge and resources, and using the products of other DOE buildings research. The Department is currently bringing together an advisory panel of experts on integrating energy design and analysis tools into CAD systems for the AEDOT research. Input from this panel, will facilitate selection of the criteria for this prototype, selection of a design area (e.g., predesign, lighting design, windows and daylighting design) which this prototype will include, the conceptual design of the prototype energy design assistance. Discussions on possible cost-sharing opportunities and industry/government consortiums are being held.

Question: How is it related to the other interaction work?

Answer: AEDOT will provide the designer or design team with energy design assistance in the critical early design period within an integrated computer-aided design environment, which in the future will be used for aspects of design, construction, commissioning and operation. This makes AEDOT an application tool for building technology research, including interaction work.

An effective design for any system must include provisions for the way in which the parts fit together or interact. Because buildings are generally unique in their design, and are built one at a time, and because the building industry is so fragmented, the interaction of the parts is not normally given proper consideration from an energy perspective. The common link between the building components, systems, and their interactions is the designer. But designers often lack specific knowledge about how many of the system interactions affect building energy loads. AEDOT will automatically address these interactions and other energy related design issues.

Question: What is its purpose?

Answer: The purpose of AEDOT is to develop technologies that assist building designers in making informed energy-related design decisions and to provide intelligent computer-based aids for building management and operation. The primary product of this research will be an integrated set of software packages that can be incorporated into advanced commercial computer-aided building design (CABD) systems.

Question: Explain how you are going to develop a building instrumentation and monitoring project in 1991?

Answer: Prior to initiating any actual testing, an advisory panel will be selected with representatives from national laboratories, universities, and control manufacturers. This team of experts will provide input into the planning and implementation of this project and also represent interested parties for cost-sharing or providing in-kind services in collaboration with DOE.

The project team will select several candidate buildings (Federal buildings if possible) and characterize the buildings to gain an understanding of the current end use patterns. The first phase would develop a test bed for industry/government collaboration by initially integrating component diagnostics with building operation and ultimately studying optimization of energy using systems at a whole-building level.

This study will use monitored building data to better understand how building systems interact and to develop and demonstrate improved building instrumentation, diagnostics, and control strategies.

Question: What kind of field testing will it do?

Answer: This field testing will initially focus on current building system technologies which have been developed but not tested in a whole building environment. Such technologies might include advanced materials, windows and wall systems, and building system control strategies. Advanced control strategies designed to optimize building energy efficiency by integrating diagnostic capabilities with whole building system optimization will be analyzed. This field testing will promote research which advances energy management systems to the point where they take an active role in building operation, not only monitoring building vital signs, but providing the building operator with system optimization and diagnostics as well. It will also effectively link designers' intentions with building operation by using expert system technology within energy management systems, and will provide incentives to industry for a standard control protocol agreement.

Question: How does this concept differ from the whole buildings research laboratory concept?

Answer: This concept is the Department's recommended alternative to the building system integration laboratory. As a result of the Building System Integration Laboratory feasibility study, the Administration believes that many of the objectives of the commercial building system integration program can be obtained through careful instrumentation and monitoring of new and existing buildings without constructing a dedicated laboratory. This project will allow us to test this approach.

Industrialized Housing

Question: Explain what you expect to accomplish with the industrialized housing program?

Answer: Housing that is at least 25% more energy efficient than the strictest U.S. residential codes and less costly than current homes is possible with improvements in design, manufacturing, construction, materials, and components. The goal of the industrialized housing research program is to develop new knowledge and technology that will produce energy efficient, affordable, and marketable industrialized housing.

This research will promote a healthy and competitive domestic industry, with potential to expand into foreign markets. Industrialized housing is an increasingly important segment of U.S. housing, especially in light of advances that are occurring in Japan and Scandinavia.

Question: What specific work is being accomplished by the University of Oregon and the Florida Solar Energy Center?

Answer: The University of Oregon has analyzed the potential for energy efficiency in industrialized housing through evaluation of U.S. and foreign industries, and has identified specific research topics that should be pursued. The development of design tools to make it easier for manufacturers of panelized housing to consider energy efficiency during the design stage is underway.

The Florida Solar Energy Center has analyzed the industrial processes used in typical housing manufacturing operations and made recommendations that would improve energy efficiency. Side-by-side testing of prototype industrialized and conventional test houses is underway.

Question: What industrial involvement is there in the program?

Answer: Currently the non-federal contribution of funding and services amounts to approximately 30% of the program costs. This comes from G.E. Plastics and Dow Chemical (large business), American Ingenuity (small business), the American Foam Manufacturers Association (trade associations) and the States of Florida and Oregon (university systems). More funding is expected as the program progresses. The project team is currently in negotiation with two other large companies, Weyerhauser Corporation and U.S. Gypsum. Technical oversight for the program is the responsibility of a steering committee that is largely from the home building industry. This committee is charged with review of the program's strategic research plans as well as its products. The two centers are also working directly with home builders and their suppliers, on individual program tasks. Most of these groups are also contributing monetarily or with in-kind assistance.

Question: What particular aspects of industrialized housing are those that need research and development effort?

Answer: The program should focus on improving design and system integration using computer and other new engineered production techniques; improving productivity; advancing the state-of-the-art of assembly line functions to reduce construction tolerances; developing new joining technologies, materials, and components; and improving installation and site erection, another area where a high proportion of energy efficiency can be built into housing.

Specific examples include:

- incorporating greater quality control into the home manufacturing process. Industrialized housing in this country is far behind housing produced in Japan and Sweden;
- incorporating energy efficient systems and components into industrialized housing, such as advanced windows, building materials, mechanical equipment, and load management strategies that can be integrated into housing in a factory;
- developing housing construction techniques that use more energy efficient materials and components that are difficult to employ in site construction but easy to use in a factory environment; and, adopting engineering principles involving artificial intelligence, industrial engineering, and other advances in manufacturing processes that are successfully used by the aerospace and automotive industries worldwide.

Question: What is your assessment of the need for a "joint venture" as recently authorized by Congress or other mechanisms to demonstrate energy efficient manufactured housing?

Answer: The Department sees the joint venture approach as an attractive way to leverage Federal funding and create new Federal-industry partnerships in general, although no decisions have been made regarding the needs for a joint venture in manufactured housing.

DOE has begun to survey industrialized housing producers, production builders, and material and components manufacturers, and their respective trade associations, to assess the need for and interest in such a program. This information will help direct the Department's position on future funding requests.

Question: Could such an initiative be coordinated with HUD for public housing projects?

Answer: Yes. Working with HUD on single-family, duplex, and townhouse housing could be the basis for a public-private joint venture for demonstrating new industrialization processes, new housing designs, advanced materials and components, and advanced construction procedures. A test-bed could be created to demonstrate new technologies, techniques, and processes developed by the industrialized housing research program and other residential research programs in a controlled situation.

Question: Do you expect to field test individual houses manufactured by individual manufacturers in this program?

Answer: As part of the industrialized housing research program, the two centers (Florida and Oregon) will design, construct, and test energy efficient single and multi-family prototypes that have been improved through advanced industrialization processes, design, materials, and components. The program will also include side-by-side field trials of small test structures using innovative construction systems to obtain baseline performance data. Finally, post-occupancy evaluations will be conducted to validate test assumptions regarding occupant satisfaction, and assess market value and user perceptions of the energy conserving features. Some of the test structures are currently being tested at the Florida Solar Energy Center. Individual tests will only be conducted if they benefit the entire research agenda and not single companies. Individual companies can arrange to have comparable tests performed on their own products by contracting privately with the University of Oregon and the FSEC.

Existing Buildings Research

Question: What projects were selected in 1989 for retrofit as a result of your competitive procurement?

Answer: The winners of the Existing Building Efficiency Research solicitation and the amounts they requested are listed below:

Proposal	Offeror Name	Federal Funding
1.	Northgate Non-Profit & Burlington Electric	$ 58,034
2.	New York State Energy Office	$105,282
3.	Florida Solar Energy Center	$ 79,382
4.	Texas A&M	$ 58,691

5.	Central Vermont Public Service Commission	$103,588
6.	Passive Solar Industries Council	$ 24,670
7.	Cornell University	$ 98,910
8.	Wisconsin Energy Conservation Corporation	$ 74,965
9.	Sud Associates	$ 79,396
10.		

Question: What technologies are being tested?

Answer: The technologies are listed below and correspond to the proposal numbers above:

1. Establish a model for improving the energy efficiency of HUD affordable housing projects.
2. Establish the persistence of window and heating system retrofits in multifamily buildings.
3. Monitor before and after energy use and weather data for specific warm climate retrofits: Infiltration reduction; window treatment; attic insulation; A/C replacement with high efficiency unit; and A/C duct sealing and taping.
4. Use energy management and control system to monitor performance of energy efficiency improvement projects.
5. Develop and test an innovative retrofit program aimed at small commercial buildings.
6. Modify an existing guidebook (an energy design and analysis tool) to use in retrofit and remodeling applications.
7. Develop, conduct and analyze effects of an innovative conservation education program.
8. Analyze the persistence of energy savings from retrofits to gas heated residences in Wisconsin.
9. Develop, design and optimize procedures for waste heat recovery devices for restaurants, install the devices and monitor results.
10. Develop an information package showing engineering firms that energy services can be sold to owners and developers successfully.

Question: What additional cost-shared field tests are anticipated in FY 1991? (p. 282)

Answer: DOE has field tested combinations of envelope and equipment retrofits at selected sites in New York, Oklahoma, Wisconsin, and North Carolina. These projects were cost shared with local utilities, the State Weatherization Assistance Program, and Public Service Commissions. Data collected at these sites will provide valuable information in the development of audits that will apply to different regions of the nation. Additional sites in Southern, Midwest and Western climates need to be tested in order to select the best set of retrofit measures suited for those particular climate zones.

Question: At what cost?

Answer: Field testing (including data collection and analysis) of different combinations of energy conservation measures can take two to three years to complete. The cost (including cost sharing) could be as much as $1 to $1.5 million per zone.

Question: Why are additional tests required?

Answer: Additional tests are required in order to select the best combination of energy conservation measures for the different climate zones in the nation. Although some of the regions have been tested for single family residences, multi family field testing has not been completed at the same level. Results of this work could be implemented by the Weatherization Assistance Program, retrofit practitioners, utilities and other organizations such as the Center for Neighborhood Technology in Chicago.

Question: In the buildings program, in general, what work do you expect to do with HUD?

Answer: HUD's highest priority goal is to "Expand homeownership and affordable housing opportunities." DOE and HUD can combine their expertise and missions to increase the energy efficiency of U.S. housing. DOE will conduct studies to identify and resolve impediments to achieving energy efficiency; design methods for incorporating energy efficiency in HUD programs; develop and implement projects incorporating energy efficiency in selected HUD programs; conduct case projects, prepare procedures, manuals and provide training, monitor project activities and report on programs and evaluation of results.

Question: Will HUD provide funds for research?

Answer: At present, HUD has not budgeted any funds for supporting such research. However, HUD controls significant revenue streams that are used to pay energy cost subsidies and to rehabilitate HUD-supported housing. HUD has indicated interest in using these revenue streams to implement the energy-efficiency improvements recommended by DOE.

Question: Will this be a compilation of existing work?

Answer: Through DOE's Existing Building Efficiency Research Program, we have monitored residential buildings (single family and multi-family) and have established a knowledge base of building performance and energy use patterns. This knowledge base will assist HUD in assessing accurately the energy savings of specific retrofits, and to determine the impact of installation on comfort and occupant behavior.

Question: Will it focus on existing or new buildings?

Answer: Both, but mostly on existing buildings. For example, in the area of public housing, HUD pays over $850 million annually in energy costs and could save more than $200 million annually if energy use is reduced by 25%. DOE could develop a program to train local public housing authority personnel in building energy auditing. The audits are designed to provide easy-to-use methods of selecting the best retrofit measure or combination of retrofit measures for specific buildings and locations.

Question: Can you identify funds, through HUD and State governments, to demonstrate technologies?

Answer: HUD supports neighborhood revitalization programs through Community Development Block Grant (CDBG) funds; Rental Rehabilitation Grants; Section 312 loans; and Urban Homesteading.

More than one-third of this funding ($2.9 billion/year) goes for property rehabilitation. Agencies that operate the DOE Weatherization Assistance Program could work with these property rehabilitation agencies. DOE would help HUD develop a program for inclusion of energy efficiency at time of rehabilitation and provide information on cost-effective energy efficient technologies.

District Heating and Cooling System

Question: What is the status of selection of projects for district cooling system demonstrations?

Answer: A portion of the funding for fiscal year 1990 has been allocated to a competitive solicitation for district cooling demonstrations. Additional solicitations are not currently planned for fiscal year 1991. While we will continue to seek advances in the areas of heating and cooling fluid additives, district cooling systems, and distributed system materials in FY 1991, we will also be prepared to follow up on new or innovative concepts that may result from the FY 1990 solicitation.

Question: Are funds available for the solicitations of innovative district heating and cooling technologies in 1990 or 1991?

Answer: Funding for fiscal year 1990 has been allocated to district heating and cooling research and to a competitive solicitation for district cooling demonstrations. It is hoped that the responses to the RFP will include innovative approaches. For fiscal year 1991, support will be provided for research on heating and cooling fluid additives, district cooling systems, and distribution systems. As appropriate, additional support will be provided for innovative technologies resulting from the FY 1990 RFP.

Question: Since your reprogramming was only partly approved in 1990, do you intend to use the $325,000 originally proposed for reprogramming in a new solicitation?

Answer: In the area of Community Systems (district heating and cooling), there was $325,626 in unobligated funds at the end of fiscal year 1989. A request was submitted to the cognizant Congressional Committees to have these funds reprogrammed to support higher priority initiatives in fiscal year 1990. We presently are awaiting a response to our request from some of the cognizant Congressional Committees. Until responses are received from all of the cognizant Congressional Committees, we will hold these funds in reserve to support the initiatives as stated in our reprogramming request.

Question: What was the total amount of the solicitation from which these funds are available?

Answer: The amount initially allocated to the solicitation was $600,000.

Community Systems

Question: For the Urban Consortium, why was the contracting method changed from a grant to a cooperative agreement?

Answer: Both grants and cooperative agreements are financial assistance instruments. A cooperative agreement allows for greater latitude for city/federal cooperation and joint efforts through the Urban Consortium. A cooperative agreement is the best instrument for demonstrating DOE's commitment to working more closely with the Urban Consortium in planning and implementing agreed upon activities.

Technology and Consumer Products

Question: In technology and consumer products, research on more efficient products is reduced almost $3.5 million in 1991. Why are these activities decreased?

Answer: The technology and consumer products activities have supported the development of new energy efficient equipment technologies. The projects that we have been supporting have reached the point of successful proof of concept and the further work involves product engineering and field testing. The budget assumes a higher level of industry cost-sharing as these products approach entry into the commercial market.

Technology and Consumer Products - Heat Pumps

Question: Heat Pump work in all technologies is being reduced. Why?

Answer: The thermally activated heat pump work is a multi-year program that has supported innovative concepts from laboratory experiments through proof of concept at the bench scale to proof of performance of assembled units. The future work addresses product engineering, field testing and commercialization. At this stage, we believe the potential manufacturers should take over a higher portion of the cost with a reduction in the funding required from DOE.

Question: Does this slow down the work?

Answer: That depends on whether the individual participants are willing to increase their cost sharing as these technologies approach commercialization.

Question: If so, what funding would be necessary to keep it on original schedule?

Answer: Since the Department believes that industry should begin to shoulder a larger portion of the cost of product engineering and field testing, work on the current technologies should be able to progress on its original schedule with the Federal funding included in FY 1991. Increased industrial participation of $3,900,000 would be required from utilities and heat pump manufacturers to maintain original schedules on current technology efforts. The requested funding is sufficient to begin to explore the potential of other advanced concepts in this area.

Question: How is your program related to that of the Gas Research Institute?

Answer: The Gas Research Institute (GRI) focuses its research on the near-term development and commercialization of gas fired heat pumps using absorption, I.C. engine and Stirling engine technology for residential and commercial application. The role of DOE in the thermally activated heat pump program is one of developing longer term technologies with potentially higher payoff. The DOE program brings technologies to the point where the private sector can adapt them. One such example is the triple effect cycle, where DOE performed the R&D before a licensing agreement was issued to GRI and Trane for product development, engineering and commercialization.

Question: Are they increasing or decreasing this program?

Answer: GRI's funding in the gas heat pump program has increased to 11.4 million dollars in 1990 with 4.3 million expected from other sources. Special emphasis is placed on near term technologies in gas fired heat pumps leading to manufacturing support, field testing and commercialization of near-term hardware developments.

Question: How long will it be before any of the technologies on which your are working become commercial?

Answer: In the area of residential size advanced absorption heat pumps, a prototype unit is under initial laboratory test and development. By the end of FY 1991 the first field test units are scheduled to be completed at the contractor facilities. Participation of major manufacturer of HVAC equipment is being negotiated, and commercial introduction is targeted for 1994. Stirling and I.C. engines address different markets than does the absorption heat pump. If industry maintains its interest, these technologies could be ready for commercial introduction in the 1995-1999 period.

Question: What are the main impediments to commercialization?

Answer: Manufacturers are concerned that the market for gas heat pumps may not be strong enough yet to support commercialization. There is concern that this technology may not be as reliable as existing technologies and that an infrastructure for installing and servicing equipment is not in place. The technology would also have to have clear economic advantage over electric heat pumps for consumers to be interested in switching.

Question: Do those companies who would produce heat pumps commercially participate in your program?

Answer: The largest manufacturers of HVAC equipment, namely Trane, Carrier and Mammoth, have been involved in the program. Trane and GRI teamed together and licensed the advanced absorption triple effect cycle heat pump, a technology developed by DOE.

Negotiations are underway with a major manufacturer of HVAC equipment to manufacture and market residential absorption heat pumps developed by DOE. Other large firms, such as John Deere and Cummins Diesel, are participating in the Stirling engine program and can supply critical component technology to the HVAC product manufacturers. Lennox was involved in the test and evaluation of the Free Piston Stirling Engine driven heat pump developed jointly by DOE and GRI.

Question: Are companies involved in Stirling Engine technology aligned with commercial heat pumps? If so, who?

Answer: The R&D companies involved are aligned with key firms which can manufacture engine technology and supply components to HVAC manufacturers. Cummins Diesel is involved with the Solar Stirling program evaluating another R & D development. Lennox was involved in the Free Piston Stirling Engine program. John Deere is involved in the value engineering of a concept of hydraulically coupling the Stirling engine to the refrigeration compressor.

Technology and Consumer Products - Chlorofluorocarbons (CFCs)

Question: Where are you testing prototype non-CFC refrigerators? Whose are they?

Answer: The Department has six projects for testing prototype non-CFC refrigerators.

Two projects are at ORNL, where leading alternative refrigerants are being tested in refrigerators in cooperation with ASHRAE. In conjunction with EPA, ORNL is testing promising nonazeotropic refrigerant mixtures in one modified Amana refrigerator and testing novel dual refrigeration loops in two other modified Amana refrigerators.

Three projects are under the auspices of the Department's SBIR program, where Stirling Technology Company is developing a free-piston Stirling refrigerator; Thermal Electric Devices is conducting research on a metal hybride refrigerator; and Chronos Research Laboratories is conducting research on an electrocaloric refrigerator.

Finally, under a cooperative effort with BPA, EPA, CEC, and EPRI, SERI is developing a novel compact vacuum insulation concept to replace the CFC-blown insulation in refrigerators. In this effort, prototype panels will be provided to four manufacturers (Admiral, Polar Products, Whirlpool and WCI).

Question: For the record, describe all the work on CFCs being done throughout the Conservation Budget in 1990 and that projected for 1991.

Answer: As shown in the table below, there are 18 research activities in the Conservation Budget on developing alternatives to CFCs in FY-1990 and FY-1991. Total Conservation program funding for CFC research is $9,317,000 for FY-1990 and $8,624,000 for FY-1991.

PROGRAM	PROJECTS	FY-1990 FUNDING ($000)	FY-1991 FUNDING ($000)
Buildings and Community Systems	8	7,142	7,084
Energy Conversion and Utilization	4	840	1,150
Industrial Programs	3	760	490
Transportation Systems	3	575	0
Total	18	9,317	8,624

Buildings and Community Systems

The Buildings and Community Systems budget has eight projects in the refrigeration equipment and rigid foam insulation areas with a total funding of $7,142,000 for FY-1990 and $7,084,000 for FY-1991.

Refrigeration Equipment

o Expand cooperative research efforts with industry consortia on materials compatibility and lubricants for alternative refrigerants for CFCs.

o Initiate two-year cost-shared field evaluation of residential size advanced absorption heat pump and fabricate prototype units.

o Continue research on nonazeotropic refrigerant mixtures, including research on innovative heat exchanger concepts, for improving the performance of refrigeration cycles.

Rigid Foam Insulation

o Joint project with industry and EPA for the development and testing of rigid foam insulation made with alternative non-CFC blowing agents.

o Research on the use of reflective flake additives to improve the energy efficiency of foam insulation.

Energy Conversion and Utilization Technology

The Energy Conversion and Utilization Technology budget has four projects with a total funding of $840,000 for FY-1990 and $1,150,000 for FY-1991.

- Project for the development of magnetic energy conversion as an alternative refrigeration technology.
- Research on multiphase flow and heat transfer in small channels using nonazeotropic mixtures (for both refrigeration or heat pumps).
- Project on the prediction and measurement of mutlicomponent mixture thermo-physical data (for both refrigeration or heat pumps).
- Development of non-CFC insulations using hollow ceramic spheres, microporous foam, and aerogel materials (for industrial furnaces and appliance insulation).

Industrial Programs

The Industrial Programs budget has three projects with a total funding of $760,000 for FY-1990 and $490,000 for FY-1991.

- A project to develop an advanced 8,000 CFM Brayton Cycle recovery equipment to recover volatile organic compounds which include large amounts of CFCs from industrial process air.
- Cooperative project with Southern California Edison and EPRI for the collection of design data on recovery of solvents containing CFCs from process air using a mobile unit.
- Research project to develop a magnetic refrigerator that replaces normally used CFC refrigerants with magnetic solid materials.

Transportation Systems

The Transportation Systems budget has three integrated CFC efforts underway with a total funding of $575,000 for FY-1990. Funding was not requested for FY-1991, as it is not clear that additional Federal support in this area is necessary and as investigations started in FY-1990 have not been completed.

- A cooperative project with Dow Chemical, developing advanced coatings for automobile windows to reduce the cooling requirements and modifying existing computer models developed for calculating heat loads in buildings to estimate the effect of the new coatings on the temperatures of automobile passenger compartments.

- A project to evaluate the safety issues concerned with the use of non-inert refrigerants as substitutes for CFC working fluids in automotive air conditioning systems, focusing on the potential for advanced technologies to reduce risks associated with the flammability properties of non-inert refrigerants.

- An investigation under an industry contract to determine the potential for mixing CFC-12 with non-CFC fluids as a suitable replacement for CFC refrigerants used in existing automotive air conditioning systems.

Technology and Consumer Products - Desiccant Systems

Question: Describe the work (that) has taken place in desiccant systems.

Answer: The DOE Solar Program has, over the past 10 years, funded research and development projects in both solid and liquid desiccants, and advanced integrated desiccant systems and materials. A brief summary of the FY 89-90 activities follows:

Solid Desiccant Systems:

- Developed and synthesized several low-cost polymeric desiccant materials that can be readily adapted for use in commercially available solid desiccant dehumidifiers.

- Commissioned test facility and began testing the effect of cigarette smoke together with moisture and other airborne contaminants on the degradation of commercially available desiccant materials and analytically determined the impact of this loss of performance on the capacity and efficiency of desiccant systems.

- Evaluated performance of several prototypical desiccant heat and mass transfer dehumidifier configurations with various passage spacings, geometric configurations, desiccant material thicknesses and absorption characteristics; developed optimal material-geometric configurations suitable for use in commercially available desiccant systems.

Liquid Desiccant Systems:

- Developed and tested prototype liquid desiccant system suitable for use in residential buildings.

- Developed hybrid open cycle desiccant absorption system suitable for use in solar buildings applications.

Distributed Desiccant Systems:

- o Constructed and calibrated moisture measurement test facility to measure moisture absorption of common building materials and fabrics when exposed to indoor air humidity conditions.
- o Completed initial analytical investigation of the use of desiccant materials distributed uniformly over the building's interior surfaces for control of indoor air humidity thereby reducing or shifting peak building cooling requirements.

Question: Is the solar desiccant work complementary to work being done by the Gas Research Institute (GRI) on desiccant systems?

Answer: While GRI's desiccant program is focused on the development of commercializable gas-regenerated solid and liquid desiccant systems, the solar desiccant program effort is focused on the development of solar-regenerated desiccant systems. However, these systems are very similar in their configuration and, therefore, face many of the same problems such as desiccant contamination, system efficiency, and cost.

Question: Is there desiccant work in the Conservation budget other than the transferred solar work?

Answer: Yes, there is work underway involving a state of the art technology assessment of desiccant cooling. This work is being supported through the ongoing program for thermally assisted heat pump technology in the Building Equipment Division.

The assessment will include both commercial and residential applications for the U.S. and foreign countries, and specifically for Japan. The assessment will include basic theory, historical overview, recent R&D history, technology status summary, market assessment, and R&D needs.

Question: Can the same desiccants be used in both types of systems (solar and gas-regenerated)?

Answer: Yes. However, as with any system, desiccant selection and system design will depend on the required system performance. Moreover, as both types of systems have the inherent ability to remove contaminants from the conditioned space, and the loss of indoor air quality is now recognized as a serious problem, the choice of desiccant and system configuration will, in many cases, be determined by indoor air quality requirements rather than energy efficiency.

Question: How long will it be before such systems, either solar or gas-assisted are commercial?

Answer: Limited commercialization of both solid and liquid desiccant equipment has already occurred. There are at least four manufacturers offering commercial and institutional cooling and cogeneration systems for niche markets. However, as yet, there are no manufacturers of systems for the residential sector which constitutes the largest potential market. GRI predicts that commercialized desiccant systems will be available for all building applications by the mid-1990s. Moreover, it is anticipated that overseas competition will be a significant factor in accelerating product availability.

Question: Why is the research decreased in 1991?

Answer: Federal funding of desiccant research is decreased in 1991 while the need for future Federal work in this area is reviewed by DOE. The Gas Research Institute (GRI) has been conducting research in this area for many years. DOE is undertaking an assessment of the R&D needs in the desiccant are which will provide the basis for future budget requests.

Question: What work will be slowed or eliminated in 1991?

Answer: Modeling of moisture heat transport in buildings will be slowed and evaluation of performance of advanced dessicant dehumidifier concepts will be eliminated.

Question: How much funding would be necessary to continue it on schedule?

Answer: To successfully meet the schedule as planned would require about $2.0 million in FY1991. However, because of changes in the disiccant field, DOE believes the original schedule needs to be reviewed as part of an assessment of DOE's desiccant program.

Oil Heating Research

Question: Has the oil heating research program been beneficial to oil heating customers?

Answer: Yes, the following benefits have been realized by oil heating customers:

- o A new generation of high efficiency oil fueled burners, furnaces, and boilers, has been developed. For example, the flame retention head oil burner alone is currently saving customers approximately 44 trillion BTUs annually and is projected to save 0.14 quads annually by the year 2000.

- A new control strategy has been developed which adjusts furnaces after installation to their optimum efficiency and prevents performance degradation of oil-fueled burners. A control sensor has been developed and a patent application is pending. This new control has the potential of reducing the number of service calls required for routine servicing.
- Also, new venting techniques being investigated will save the home builder and the customer several hundreds of dollars per house due to eliminating the need for a chimney in new construction. This involves direct through-the-wall venting for oil furnaces and boilers.

Question: If so, why is it being eliminated in 1991?

Answer: The number of homes using oil heating is small and shrinking and located primarily in one region of the country, the Northeast. With limited funds available, the Department proposes to focus its R&D efforts in areas where larger savings are possible and where the benefits are more national in scope.

Question: If it were funded at levels equivalent to 1990, what work could be accomplished?

Answer: Ongoing research would be continued in the following areas:

- Work on control strategies to further the ability to address efficiency degradation in oil fired equipment.
- Studies of fuel oil quality and its effects on efficiency degradation, including the effects of chemical additives and burner modifications.
- Studies on fuel oil atomization and advanced burner technology with respect to emissions of nitrogen oxides, carbon dioxide, sulfur dioxide, and particulates.
- Targeting specific needs for technology transfer to consumers, and the oil heat industry.
- The availability for the first time to the oil heat industry of a venting simulation model including a computer program, vent tables and other dynamic venting data that will allow vent system designers and installers to properly size venting and address problems such as back drafting, spilling of combustion products into the house, and the accompanied efficiency degradation.

Technology and Consumer Products - Advanced Lighting

Question: Why is advanced phosphor materials research reduced in 1991?

Answer: Continued funding of advanced phosphor materials research is of lower priority for Federal funding than other lighting research. This research is done by GTE (Sylvania) under subcontract from LBL and is far enough along to be supported entirely be GTE after FY 1990.

Question: What is its status?

Answer: Currently, the advanced phosphor materials effort is focusing on development of a multi-photon phosphor for fluorescent lamps. During the first phase of this project, researchers experimentally confirmed that the basic phenomena of a multi-photon phosphor occurs. This research was carried out by a team of industry researchers at the National Synchroton Light Source at Brookhaven National Laboratory. During the second phase of effort, work is focused on evaluating a large number of candidate phosphor materials to increase the efficiency of the phosphor conversion at energy levels consistent with lamp application. Results are pointing toward a lamp with no mercury in the gas fill, and thus with improved environmental benefits.

Question: What cost-sharing is there on this project?

Answer: GTE Lighting is carrying out this multi-photon phosphor research under subcontract and is cost-sharing in the form of personnel, purchase or special-purpose equipment and in-kind costs. This represents about 40% of total project costs being cost-shared.

Question: What funding by year would be necessary to complete the project?

Answer: The project on multi-photon phosphors initially called for continued DOE support for one more year to complete this phase of the joint industry-DOE advanced phosphor program. However, the project is now far enough along so that DOE will seek to pass future support to industry in FY 1991. Further development of this multi-photon phosphor is intended to be carried out solely by industry at a level of $600,000 per year.

Question: What is the potential for this technology?

Answer: The advanced phosphor materials project has the theoretical potential for doubling the efficiency of fluorescent lamps. The initial DOE goals for the first generation lamps are ot increase efficiency of 25%. That gain will be significant enough to stimulate continued development in the private sector.

Question: At the reduced levels for 1991, will all projects except advanced phosphors continue on schedule?

Answer: In the light source area, work will continue on a new configuration of the surface wave lamp. This configuration does not rely on surface waves excitation exclusively but extends a plasma discharge well beyond the ends of the wave guide through capacitative effects. An efficient low-cost, high-frequency power supply needed for operating any of these lamps can be developed at a later date in conjunction with industry.

In the Impacts and Applications area, work will continue to study health effects of changing the spectral characteristics of lamps. There is preliminary evidence that in changing a lamp's color to a scotopic spectrum, the eye adapts to give acceptable resolution and visibility though at decreased total power. Work in lamp thermal controls will be continued, though at a reduced level unless co-funding can be obtained from the California Energy Commission. Work on computer aided design will be limited in scope. Work on quality illumination standards will continue at a reduced level.

Question: If not, what funding would be necessary to do that?

Answer: The advanced phosphor research accounts for $0.5 million out of the $2.55 million advanced lighting budget for FY 1990. Continuing all other current activities would require an additional $0.45 million.

Question: What are the other specific projects and their potentials?

Answer: In the light sources area, the high frequency power supply effort is aimed at developing, in cooperation with industry, solid-state electronics technology integrated with the surface wave lamp. This technology which is beyond today's state-of-the-art is critical to achieving a surface wave lamp product which will have a 40% increase in efficiency compared to conventional fluorescent lamps.

In the applications and impacts area, research on lighting/HVAC/envelope interactions and on computer-aided design will provide data, guidelines and computer-based tools for cost-effectively producing energy saving lighting designs with an appropriate level and quality of illumination. The lamp flicker and discomfort glare research and the field study of solid-state ballasts will provide a basis for increased market penetration of solid-state ballasts (with an energy savings of 25%) and the advanced light sources being developed by DOE.

Question: In lighting impacts, is the computer-aided design work completed as of 1990? (p. 290)

Answer: The computer-aided design work in the lighting impacts and applications area will not be completed in 1990.

Question: If not, is it funded in 1991?

Answer: The FY 1991 request includes no further funding for the computer-aided design project. It was not deemed a high priority project relative to other activities in conservation.

Question: If not funded, how much would it cost to continue this work?

Answer: It would cost $300,000 per year to continue this work. Because it is lower priority than other research activities, finding for it has not been requested in 1991.

Question: Who would use this program when completed?

Answer: This program would be used by lighting designers and architects to optimize the lighting system (selection and placement of lamps and fixtures) in buildings through computer generated images of interior environments and quantitative assessment of luminance.

Question: If funding were available at 1990 pre-sequestration levels for technology and consumer products, in what areas would you, by priority sequence, recommend funds be provided?

Answer: The FY 1991 request for Technology and Consumer Products is $10,674,000 compared to an FY 1990 presequestration level of $14,161,000. If an additional $3,487,000 were made available, it could be applied to the following activities:

($ in thousands)

	Funding	Cumulative
FY 1991 Request	$10,674	$10,674
1. Absorption	+ 1,187	11,861
2. Light Sources	+ 400	12,261
3. Solar Cooling & Dehumidification	+ 400	12,661
4. Thermal Combustion and Distribution	+ 600	13,261
5. Stirling and I.C. Engine Technology	+ 600	13,861
6. Lighting Impacts and Application	+ 300	14,161
Total		14,161

However, we believe that the FY 1991 budget request for Technology and Consumer Products is appropriate and well-balanced, and adequately funds the most promising technologies.Technology Assessment and Transfer

Question: Please explain why IEA support and studies of foreign conservation programs are funded here instead of under the International Research Monitoring effort in the Multi-Sector area. (Pages 293 and 404)

Answer: The IEA support and studies of foreign conservation programs located here support work in the buildings sector. The IEA activities cover collaborative R&D in the areas of buildings energy research, advanced heat pumps, and district heating and cooling. The studies are performed by the International Energy Analysis group at LBL and focus on changing patterns of energy use within the building sectors of developed and developing countries. This LBL work is heavily cost-shared by other government agencies and private companies. The International Research Monitoring activity follows energy developments as reported in the scientific and technical literature of the advanced countries.

Question: Please explain what the function of CADDET is.

Answer: CADDET, the IEA Center for the Analysis and Dissemination of Demonstrated Energy Technologies, is responsible for collecting and disseminating information on demonstrated, energy-efficient technologies. CADDET focuses on demonstration projects and is the mechanism for diffusing the results of such projects among the member countries.

The information is disseminated through quarterly newsletters, brochures describing major successful demonstrations, analyses of demonstrations in specific end use areas, and a computerized data base of more than 1,000 demonstrations, about one-fourth from the United States. The U.S. participation in CADDET is through an 80 member National Team, composed of representatives from industry, utilities, trade associations, non-Federal research institutes, and universities. The CADDET information is disseminated to a growing list of more than 1,200 participants in the U.S.

Question: Who else supports the Center?

Answer: CADDET is supported by thirteen countries: Australia, Canada, Denmark, Finland, Italy, Japan, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States. Several other countries have expressed interest in joining CADDET, including the European community, France and Germany.

Question: Explain the expected make up of teams you intend to establish in 1991 to study building technologies and practices.

Answer: Most of the programs have technical advisory panels that periodically review the research and advise on its strengths and weaknesses. These new teams would include persons from industry, universities and associations that have expertise in the program area, but are not now involved in the research or the existing advisory panels to provide an independent assessment of the merits and potential of the programs.

Question: Do you not think that the experience of the past 15 years and the continuing interaction with industry and research groups has provided enough insight on development needs to your managers?

Answer: The interaction between the DOE program managers and industry and research groups for most of the 1980s has focused on long-term research needs and activities. The Department continues to support a core program of long-term research, but has added a new thrust aimed at getting new energy efficient technologies accepted and used. The increase in funding for Analysis and Technology Transfer will provide the information we need to plan and implement this new thrust.

Question: What additional or different areas of research do you expect to uncover?

Answer: During most of the 1980s, the Department's energy efficiency activities were often in a reactive mode. Now that the Department is giving new priority to energy efficiency and renewables, the current portfolio of programs is being reviewed and some programs are being completed and redirected and other new programs are being initiated. The new directions emerging from the National Energy Strategy will help guide these changes. The FY 1991 budget reflects some of these changes. The NES and FY1992 budget will reflect further these new directions. While the process is still underway, we now believe the changes will give higher priority to energy-efficient alternatives for CFCs, to indoor air quality, to the Federal Energy Management Program, to the statutory building standards and appliance standards programs, and to jointly funded R&D and product development projects with industries and utilities.

Question: Please explain what you intend to do in your "campaign" to increase adoption of available conservation technologies.

Answer: We will work directly with the building industry through its trade and professional associations to promote adoption of the Uniform Home Energy Rating and Energy-Efficient Mortgage System. The DOE-HUD Initiative will combine the expertise of both departments to concentrate on low-income public housing and weatherization. It will include potential collaborative efforts with industry to introduce new and emerging building technologies into the marketplace.

Question: Explain what BEACON is, and how it will work.

Answer: BEACON, Building Efficiency and Conservation Network, is an information exchange network. It will gather information from the specialized centers and researchers to meet the individual information needs and requirements of architects, builders, designers, vendors, and others.

Question: How is this function different than the work in compiling building performance information in Building Energy Compilation and Analysis; the work in technology transfer with associations, industry, and the public sector; the work on data dissemination in Least Cost Utility Planning/Integrated Resource Planning.

Answer: Building Energy Compilation and Analysis, the BECA database provides measured performance data on buildings and equipment. Its primary function is to convert measurements into standard energy performance indicators which allows researchers and policymakers to determine effectiveness of energy-efficient technologies. The technology transfer work with associations, industry, and the public sector relies on published documents and training institutes prepared for these groups. The data dissemination in Least Cost Utility Planning/Integrated Resource Planning concentrates on providing published documents to the utilities. BEACON differs from these other efforts because it provides on-call tailored information to a selected audience. BEACON will use any information from the above sources as well as other materials to answer inquiries.

Appliance Standards

Question: Are there appliances covered by the standards that need not be covered?

Answer: Yes.

Question: If so, which ones?

Answer: Television sets and pool heaters. In the aggregate these appliances use approximately 0.2 Quad per year; and energy conservation regulations are likely to save a small portion of that amount. For example, the saturation of pool heaters nationally is very low. On the other hand, while the saturation of television sets is extremely high, the technology is continuing to advance rapidly. Advances in electronics are continuing to reduce television energy consumption. These advances are often driven by factors other than energy consumption, e.g., cost and consumer utility. It appears best to let the marketplace continue to function as it has to date.

Question: On the other hand are there appliances that should be covered that are not?

Answer: Commercial lighting consumes about 4 Quads for energy per year and represents a significant potential for energy savings. However, no recommendation can be made pending completion of the study of ways to increase commercial lighting efficiency.

Question: If so, what are your plans for trying to get them covered by the law?

Answer: No plans have been made pending the completion of the study of ways to increase commercial lighting efficiency that is to be performed as part of the Department's Relighting Commercial Buildings initiative.

State and Local Programs - Weatherization

Question: Is it your assessment that the weatherization program saves energy?

Answer: The Weatherization Assistance Program installs energy conservation materials in the homes of low-income persons, particularly the elderly and handicapped, which helps to reduce the energy consumption in their homes. The last national energy savings evaluation, completed in August 1984, showed that about 14 percent of heating energy was saved after weatherization. Currently, the Department of Energy is undertaking a rigorous national evaluation of the Weatherization Assistance Program. We will be happy to report the results of this evaluation to the committee as products are completed during the course of the evaluation over the next three years.

Question: Is it your assessment that without programs like DOE's that these homes would not be weatherized?

Answer: The Petroleum Violation Escrow (PVE) funds will remain a stable source of support for Weatherization programs for several years. As of the end of FY 1989, the States had not yet expended more than half of the PVE funds they have received. Furthermore, the consent order with Texaco provides that the States will receive $340 million plus accrued interest in PVE payments over the next 4 years. Other oil overcharge cases are still to be decided. There are other resources available to support the weatherization of low income homes. HHS has authority under the LIHEAP and emergency programs to provide weatherization assistance. HUD also has authority under its rehabilitation repair programs to do low-income weatherization.

Question: By reducing your funding by $146 million, do you believe less homes will be weatherized?

Answer: We believe the States have sufficient resources available through the Petroleum Violation Escrow funds to sustain stable support for Weatherization programs. Because the participation of utility and private organizations in the WAP is increasing, the number of homes weatherized could even increase above current levels.

Question: Is it not correct that the dollars to be allocated to weatherization from other programs, including petroleum overcharge funds, are expected to begin dropping in 1990?

Answer: As of the end of FY 1989, every State had an amount of unexpended PVE funds equal to more than a full year of appropriated grant funds. Forty-eight (48) States had unexpended funds equal to more than two years of appropriated grant funds. In future years, the Petroleum Violation Escrow (PVE) funds are expected to be a continuing but declining source of new funds to the States.

Question: Is it not also correct that some States have already used most of their petroleum overcharge funds?

Answer: In every one of the 50 States, the amount of Petroleum Violation Escrow (PVE) funds that remains unexpended exceeds the total of their program grants in the current fiscal year, and in all but two States, the amount remaining is twice the total of their program grants. Furthermore, the consent order with Texaco provides that the States will receive $340 million plus accrued interest in PVE payments over the next 4 years. Other oil overcharge cases are still to be decided.

Question: Is it also true that some States received few petroleum overcharge funds but have large weatherization needs?

Answer: Under terms of the court settlements, allocation of oil overcharge monies among approved programs and activities is at the option of each individual State. Based upon what the States have reported to DOE as of September 30, 1989, a total of $678.4 million has been allocated by them for use in the Weatherization Assistance Program (WAP). Of this amount, $589.8 million had actually been proposed, in State plans through the end of FY 1989, for use in the WAP. As of September 30, 1989, States had reported PVE expenditures of $333.3 million on the WAP. Every State has enough Petroleum Violation Escrow money to exceed its current level of program grant funding.

Question: Is it not correct that around 80 percent of all eligible residences remain to be weatherized?

Answer: Of approximately 22 million households currently eligible for weatherization assistance, over 4 million have been weatherized using the Department of Energy/Weatherization Assistance Program, Petroleum Violation Escrow, or Low-Income Home Energy Assistance Program funds. State and utility funds have also weatherized an unknown but not insubstantial number. Therefore, it is difficult to say with certainty what the universe of eligible homes is at this time. We plan to collect data on State and utility weatherization efforts during the course of the Weatherization Assistance Program evaluation, which was recently initiated. A report covering this information is expected by mid-1991.

Question: In the face of all this why are you recommending elimination of the general grant program?

Answer: We believe additional appropriations are not a high priority when there is a need for fiscal restraint and when substantial resources remain available to the States to allocate to this program as they see fit. The States have received more than $3.5 billion in restitutionary funds from Petroleum Violation Escrow (PVE) accounts; more than half of these funds remain unexpended. In every one of the 50 States, the amount of PVE funds that remains unexpended exceeds the total of the State's DOE grants (including weatherization) for the current fiscal year, and in all but two States, the amount remaining is twice the total of the DOE grants. Thus, the DOE FY 1991 budget request assumes that States can use these PVE monies to fund such energy conservation grant activities as they choose, under the terms of the PVE settlement agreement.

Question: Do low-income homes not meet the criteria you set for encouraging near term energy efficiency?

Answer: The Department has requested $212.6 million for energy conservation in FY 1991, which is 223 percent over the FY 1990 request and 10 percent over the FY 1990 appropriation. It is a budget which is attentive to future market needs and opportunities; which is responsive to energy, economic, and environmental goals; which is balanced by end use and time frame of delivery; and which will serve as a catalyst for progress in the private sector. Making a budget means making choices. While the Weatherization program has important benefits in increasing the comfort of low-income recipients and reducing their need for energy assistance, on the basis of energy savings alone it provides a comparatively low return on the Federal investment, particularly when substantial resources remain available to this program through PVE accounts.

Question: Explain your incentives programs in 1991. (p. 437)

Answer: The $15 million incentive fund, as proposed in the FY 1991 budget submission, would have two purposes/components:

- o Five million dollars for competitively selected State proposals to test innovative approaches to low-income weatherization.
- o Ten million dollars in matching funds to encourage States to leverage $20 million to $30 million from non-governmental sources.

These activities will encourage, and provide for evaluation of, alternative service delivery and resource leveraging mechanisms.

Question: Is legislation required to carry out the program?

Answer: No, sufficient authority exists within the Department of Energy to carry out the incentive program as presently envisioned.

Question: What kinds of innovative approaches to weatherization might you expect, since you have been operating this program for a long time?

Answer: The innovations would be proposed by the States in response to a competitive solicitation. We have no way of knowing in advance what the full range of proposals, based on individual State experience and circumstances, might be. We do expect, however, that proposals would include:

- o New approaches to home energy audits, e.g., new audit protocols, audits tailored to reflect energy savings potential and payback on the basis of individual buildings, household characteristics, and client behavior;
- o Innovative approaches to client education;
- o Model ways to coordinate service delivery across program lines, e.g., WAP, LIHEAP, and various HUD low-income housing efforts;

- New approaches (e.g., training centers, curricula) to training local subgrantee personnel; and
- New approaches to information sharing and technology transfer.

Question: Your justification says successful innovations will be integrated into the base program. What base program?

Answer: The "base program" referred to is the existing weatherization activity in 50 States, the District of Columbia, and 9 Indian Tribes and involving nearly 1,200 local agencies. The base program is currently funded by a combination of DOE appropriations, Petroleum Violation Escrow funds, and funds transferred to weatherization from the Low-Income Home Energy Assistance Program managed by the Department of Health and Human Services.

Question: What kinds of actions could be undertaken in your "leveraging" initiative that can't be taken now?

Answer: The leveraging initiative is not intended to authorize activities that can't be undertaken now. It is intended to encourage States to attract additional non-Federal resources--e.g., from utility programs, owners of rental properties eligible for weatherization, and fuel fund programs established by States--to provide additional support to the Weatherization program.

Question: Please provide the details of how you expect to carry out your evaluation of the weatherization program. (p. 437)

Answer: Weatherization Assistance Program (WAP) operations and regulations have changed substantially since 1981, the last year of program impact that was studied in a national level evaluation. DOE recognizes the need for a more current national level evaluation of WAP impact and potential and has developed a plan for undertaking that task.

The national WAP evaluation as currently proposed has six major goals:

- to estimate energy savings due to the program;
- to analyze factors which may cause savings to vary;
- to assess program cost effectiveness;
- to define the weatherization network's capabilities;
- to assess non-energy impacts, e.g., health, safety, and comfort; and
- to characterize WAP leveraging and the eligible population.

Each of these major goals is addressed by one or more of the five separate studies that are currently planned as part of the overall evaluation. The five studies are as follows:

- snapshot of weatherization potential;
- profile of leveraging and eligible clients;
- fuel oil study;
- gas/electricity study; and
- high density multifamily study.

We have selected study and stratification variables and report foci that address the predominant segments of the program such as gas, electricity and fuel oil. In our judgment this will provide the most useful information to the greatest number of program decisionmakers at a cost acceptable to DOE. The data collection, analyses and reports are to be completed in phases over the next 3 1/2 years. The evaluation methodologies and reports planned vary by fuel type, housing type and climate zones.

For gas and electrically heated/cooled homes, analysis will be based on retrospective utility billing records (collected for pre- and post- retrofit years), which will be weather-adjusted using the Princeton Scorekeeping Method. A nationally representative sample and control group will be used. Results will be reported both for the program as a whole and for four climate regions. For fuel oil heated homes, a prospective analysis will be conducted using metering data collected from homes scheduled for weatherization in 1991. The fuel oil study will cover the six New England States and NY, NJ and PA.

Additional information resources planned for the evaluation include: recent State evaluations; local agency sample data on capabilities, costs, delivery, measures and households served; and on-site household data including occupant behavior, non-energy savings and dwelling characteristics. Additionally, blower door and furnace efficiency testing will be conducted where appropriate.

The characterization of WAP leveraging and the WAP eligible population will rely on portions of the above study data and information gathered from the States and utilities to determine the number of WAP eligible households served, the number not yet served and their demographics. The study will also analyze sources of funding used in that client service.

Two working groups--a methodology group and an implementation group--are planned as part of the project structure. These groups will be a major source of feedback to DOE on project focus, technical issues, and application of results.

Question: Who will perform the evaluation?

Answer: The Weatherization Assistance Program Division within DOE's Office of Technical and Financial Assistance, under the Assistant Secretary for Conservation and Renewable Energy, will manage the evaluation. Oak Ridge National Laboratory will provide the principal support for methodology, data collection, and analyses.

Question: How much will it cost by year?

Answer: The cost over four fiscal years is estimated at $1 million in FY 90, $2 million in FY 91, $1 million in FY 92 and $0.5 million in FY 93.

Question: Are sufficient funds included in 1991 to continue the evaluation?

Answer: There are sufficient funds in the FY'91 request to permit continuation of the evaluation, which is being initiated with FY 1990 funds.

Question: If not, how much is required?

Answer: Sufficient funds are expected to be available as requested in the FY 91 budget.

State and Local Programs - Schools and Hospitals

Question: What percentage of schools and hospitals has been serviced by the schools and hospitals grant program and petroleum overcharge funds?

Answer: K-12 schools serviced by the schools and hospitals grant program represent 16 percent of the eligible K-12 universe; colleges and universities serviced represent 35 percent of the eligible college and university universe; hospitals serviced represent 26 percent of the eligible hospital universe. While these figures were computed based on institutional participation in the appropriated grant program, the overall percentage of institutions serviced with the addition of petroleum overcharge funds is likely not significantly greater. This is because facilities serviced by petroleum overcharge funds are typically "repeaters"-- i.e., institutions that have, in the past, also received a grant under the appropriated grant program. These facilities represent a "core constituency" of energy efficiency adopters that is willing to engage in the grant process in order to implement necessary energy efficiency improvements.

Question: Will the number of facilities serviced in 1991 drop as a result of your budget request?

Answer: The presence of a substantial amount of unexpended petroleum overcharge funds available in the States (in some States, many times more than the FY 1990 schools and hospitals Federal allocation) would indicate that, on a national level, there will be a stable source of support for servicing school and hospital facilities for several years. We have followed the premise that individual States have the discretion, based on their own assessment of need within their State, to determine the level of resources they wish to commit to this and other conservation grant programs.

Question: Does this also effect short-term energy efficiency negatively?

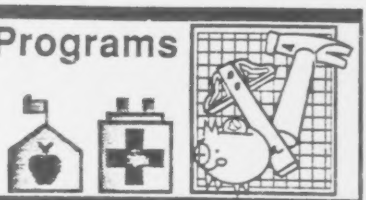
Answer: Based on the response to the previous question, there should not be a negative effect on short-term energy efficiency on a national level.

Question: Please describe the results of the 12 State innovative program development projects.

Answer: The State innovative program development projects (known as "Tier 1" projects) were the result of grants awarded to 12 State energy offices in 1986. The grants, awarded competitively, were provided to enable States to conduct leveraged, transferable, ultimately self-sufficient projects in the general areas of technology transfer and financial counseling, networking, and alternate energy efficiency financing. Nine State projects were able to continue after their Federal grant was closed.

Institutional Conservation Programs
State Tier I Project: Utah

INFORMATION BRIEF



Background

This project was conducted by the Utah Energy Office under a U.S. Department of Energy Institutional Conservation Programs (ICP) Tier I grant. Traditionally, ICP projects have consisted of three phases: energy audits, technical assistance analyses, and energy conservation retrofits. As monitoring was conducted on past retrofits, various problems have been noted. These problems reduced the effectiveness of the retrofits, and in some cases energy consumption has increased after the conservation measures were installed.

The focus of this project was on the planning and testing of a fourth phase to the ICP process, an evaluation and follow-up phase.

Approach

The first step in the project was to set up a database of ICP-participating buildings in Utah and Idaho. Using the database of energy billing histories, 38 K-12 schools and 2 small hospital buildings were selected because of their apparent poor energy retrofit performance. A site visit was then conducted at each identified building to find the source of the problem and educate building staff on corrective measures. In particular, building staff were educated on proper operation and maintenance measures and their importance. Observations from these site visits were used to plan a fourth ICP phase, which could be integrated into a State's institutional conservation program process.

Database

The software database system, "ICP Grants Manager," that was utilized in this project may also be applicable to other State ICP programs. The system allows for the tracking and management of all ICP grant buildings. Administration requirements can be tracked as well as performance parameters of the buildings themselves. Examples of particular variables tracked by the software for each grant include:

- Due dates for grant reports,
- Energy savings for years 1, 2, and 3,
- Cumulative energy savings, and
- Historical climatic data.

Key Findings

On average across all Utah buildings having received ICP grants, energy savings, as measured by utility billing histories, declined an average of 11.2% the first year after retrofit, 6.4% after year two, and 3.0% after year three.

Other findings particularly apply to K-12 institutions as they represent 38 out of 40 sites surveyed. These findings include:

- Actual energy savings (based on energy consumption records unadjusted for building usage changes) in ICP retrofitted buildings in Utah and Idaho were significantly less than predicted savings. There are several factors which may affect the project's post-retrofit energy savings calculations. These include:
  - No adjustment being made for building use changes, with the exception of square footage changes;
  - Some of the energy data probably being suspect, particularly where coal and oil are used; and
  - Adjustments to data for weather are on the basis of total BTU/ft^2/heating degree day, though not all usage is dependent on weather variations.

- The study team concluded that the addition of a fourth ICP phase (evaluation and follow-up) can achieve much of the energy savings not realized, at potentially lower cost than new retrofit projects.
- Inadequate operation and maintenance of the building and the retrofit measures were found to be a major problem in buildings not performing as predicted.
- A fourth ICP phase must include the cooperation and participation of the building operators and managers, the State energy office, the original technical auditor, the retrofit contractor, and the Federal government in order to achieve the desired goals.
- The project provides recommendations regarding the following subjects:
    - Energy-use tracking by institutions,
    - Operations Manual preparation,
    - Communication improvements between building operators and maintenance crews,
    - Operator training,
    - Technical audits,
    - Energy Conservation Measure (ECM) installation inspections,
    - Incentives, and
    - Maintenance
- Post-ECM data proved to be unreliable, requiring substantial verification before problem buildings could be identified (the two participating hospitals had valid reasons for changes in energy usage).
- Building performance problems encountered during the site visits included:
    - Lack of energy management commitment by building personnel and administrators,
    - Lack of building manager training in ECM's and building operation,
    - Possible overestimates of energy savings in original technical audits,
    - Inappropriate retrofits,
    - Bypassing ECM's, and
    - An overall lack of proper operation & maintenance procedures.

The project concludes with recommendations for solving the problems encountered, and possible financing options available, to establish this fourth phase. The project's recommended solutions to various problems with energy conservation measure installation include:

- An intensive follow-up inspection prior to paying the installation contractor,
- Training of building staff on proper operations & maintenance procedures pertaining to the retrofit equipment,
- Obtaining a second opinion on a technical auditor's energy saving estimates when costs exceed a set amount,
- Requiring operating manuals from the contractor for the equipment installed, and
- Increasing building personnel awareness of the importance of energy efficiency through energy consumption reporting and incentives.

Report: Tier I Final Report, August 1988.

For Further Information on This Project,
Contact: Utah Energy Office
355 W. North Temple
3 Triad Center, Suite 450
Salt Lake City, UT 84180-1204

For more information on the ICP, contact:

Institutional Conservation Programs
Office of State and Local Assistance Programs
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

April 1989

Institutional Conservation Programs

State Tier I Project: Tennessee

INFORMATION BRIEF

Background

To overcome various institutional barriers to energy conservation, the Tennessee Energy Division designed a Tier I project funded by the U.S. Department of Energy's Institutional Conservation Programs (ICP) to utilize existing expertise in State Board of Regents schools to provide information and services in energy conservation. In three of these schools, a network of Centers for Institutional Energy Efficiency was established to serve in this function. These Centers include:

- The Center for Institutional Energy Efficiency Finance at Memphis State University,
- The Center for Institutional Energy Efficiency Technology at Tennessee Technological University, and
- The Center for Institutional Energy Efficiency Accounting at Chattanooga State Technical Community College.

The services made available by the Centers included direct assistance, training of institutional personnel, and collecting information for the availability of institutions. This information was collected through research of options available and an accumulation of experience in assisting the institutions. In addition, these Centers provided energy coordinator services and made presentations at selected State-wide and regional meetings and conferences.

The Tennessee Energy Division was responsible for developing, directing, and coordinating the three Centers. In addition, it promoted program availability to institutions, built non-Federal support for the Centers to ensure program continuity, and provided other forms of overall program support.

Goals and Objectives

Through the use of the three Centers for Institutional Energy Efficiency, the project concentrated on three primary objectives:

- Expanding assistance and investment in institutional energy efficiency by non-Federal entities,
- Developing a permanent source of technical assistance for institutions implementing energy efficient projects, and
- Encouraging institutions to implement energy efficiency projects by helping them overcome technical and financial barriers.

Analysis Software

- The Finance Center prepared a software package using commercially available spreadsheet software. The system is called Energy Systems Retrofit Analysis (ESRA). This program can analyze various energy efficiency financing alternatives using internal rate of return and net present value analysis, with emphasis on the latter. The Financial Center is planning professional packaging of the ESRA software in the near future.
- The Accounting Center developed a public domain spreadsheet called "Energy Accounter" which can analyze 30 buildings and four years of data on each building. It calculates values of energy use and costs over time and per square foot of building area. These values are compared between buildings and/or to national averages to help isolate problem buildings and the sources of the energy use problems. An example of this process is included in the documentation which illustrates the Center's use of the program at Chattanooga State Technical Community College. Like the ESRA software, plans exist to professionally develop this software for general distribution.

Key Findings

The Finance Center accomplishments and findings include:

- A report presenting the results of a literature review that concentrated on energy efficiency project funding for non-profit institutions. Funding options discussed in detail include: Bond Fund Pools, ICP, investment tax credit, energy tax credit, Energy Service Companies, tax exempt bonds, revenue bonds, municipal leases, third-party financing, cost sharing and shared savings, joint ventures, and industrial development bonds. In addition, the report discusses factors such as: legal and tax considerations, estimation of cost savings, importance of setting a reference year for savings in an Energy Service Company contract, the accurate estimation of cost savings, factors specifically involved with financing in schools, cash flows and their timing, payback, interest and discount rates and their relation to perceived risk, Energy Service Company pre-contract considerations and proposal process, and the combining of alternatives.

- Financing approaches in the literature tend to concentrate on the lender's perspective. Institutional building operators require information on financing options from the public sector "borrower" perspective. The Finance Center's report attempts to provide this perspective.
- The 1986 tax legislation limited the opportunities of Energy Service Companies in financing; however, some of the greatest opportunities for energy conservation financing exist in the non-profit sector.

A performance contracting demonstration was conducted by the Finance Center with the following findings:

- Schools preferred to finance conservation projects with grants and cash matches rather than performance contracting, primarily due to the availability of PVE Schools and Hospitals funds.
- Some schools interested in performance contracting lacked adequate estimated savings to participate.
- There was a lack of performance contracting participation due to perceived risk exceeding gain in potential cost savings.

The Technical Center findings include:

- None of the seven energy management systems evaluated by the Center had maximized energy savings.
- Energy management system problems include sensor calibration error, programming difficulty, difficulty in start-up after a power outage, and air distribution system problems.

The Accounting Center accomplishments and findings include development of its own public domain package called "Energy Accounter," which was described above.

Report: Final Report: Tennessee's Tier I Program, December, 1988.

For Further Information on This Project, Contact: Tennessee Department of Economic and Community Development,
Energy Division
Rachel Jackson Bldg.
6th Floor, 320 6th Ave. N.
Nashville, TN 37219-5308

For more information on the ICP, contact:

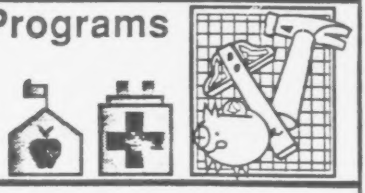
Institutional Conservation Programs
Office of State and Local Assistance Programs
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

April 1989

Institutional Conservation Programs

State Tier I Project: South Carolina

INFORMATION BRIEF



Background

The South Carolina Tier I project, funded by the U.S. Department of Energy's Institutional Conservation Programs (ICP), was designed to establish a South Carolina Energy Management Finance Authority (the Authority) to finance energy conservation projects in public buildings and facilities. The Authority would operate as a unit of the South Carolina Public Service Authority, a State-owned utility, commonly known as Santee Cooper. The Authority was to serve as the State's shared savings agent. Further, the Authority would use the capability of Santee Cooper to issue revenue bonds as a means of raising capital for the financing of energy conservation projects in public buildings.

In South Carolina, the annual energy cost to operate public buildings/facilities exceeds $220 million divided across 10,000 buildings. The State energy office estimated that as much as $60 million per year could be saved through energy conservation in these buildings. The South Carolina energy office felt that the most significant barrier to conservation in public buildings is lack of public capital to initiate conservation projects. This is because in the public sector budget process, capital improvements usually receive low priority for available funds.

As a result, the South Carolina energy office felt that the State should finance energy conservation projects in public buildings. State financing would:

- Save taxpayers money over the long run,
- Keep money in South Carolina that would otherwise be spent out-of-State for imported energy resources, and
- Create an in-state economic multiplier effect of 2.5-3 times the conservation investment.

The South Carolina Energy Management Finance Authority was perceived as a means to overcome financial barriers associated with public funding of energy conservation in institutional buildings. Overcoming the financing barrier through the issuance of revenue bonds would allow the State to receive the above benefits.

Goals and Objectives

The South Carolina Tier I project had three primary objectives:

- Support development of a State program for institutional conservation by creating an entity to operate as a non-profit shared savings agent,
- Demonstrate the use of revenue bonds as a technique to raise the necessary capital for up-front financing of shared savings projects,
- Provide a detailed analysis of the concepts underlying private sector third-party financing for energy conservation capital improvements in public buildings.

Approach

To undertake this innovative project, the South Carolina Energy Office established a Project Steering Committee. The Steering Committee included representatives of the South Carolina energy office, Santee Cooper, representatives of other South Carolina executive and legislative agencies, and representatives of private law and accounting firms with expertise in third-party financing and revenue bonding. The Steering Committee directed the overall project and was responsible for the production of project reports.

The initial effort was to develop an Operational Manual for the South Carolina Energy Management Finance Authority. The Operational Manual includes sections on:

- Authority organization,
- Program procedures and promotion,
- Project monitoring and service agreements,

- Lease/Purchase agreements,
- Vendor agreements,
- Bond issuance guidelines, and
- Financial, accounting and insurance guidelines.

The Operational Manual provided a sound framework for organizing and managing the Authority and for developing the required revenue bond issues.

In a parallel effort, the Steering Committee oversaw the development of a Third-Party Financing Guide. The Guide provides a detailed description of:

- Applicable public finance and tax law,
- The changes in this body of law rendered by the Tax Reform Act of 1986, and
- The impact of the body of law as amended on third-party financing.

The Guide thus serves as a reference tool for public or private entities interested in third-party financing.

South Carolina also established a Shared Savings Information Clearinghouse which is now being operated by the Governor's Office of Energy, Agriculture, and Natural Resources as part of the State Energy Conservation Plan. Publications and individualized technical assistance are available from the Clearinghouse for those interested in shared savings.

Key Findings

In investigating shared savings opportunities for institutional buildings, the South Carolina Tier I Project resulted in the following key findings and conclusions:

- The most significant barrier to conservation in public buildings is lack of public capital to initiate conservation projects.
- Financing of conservation projects in public buildings through revenue bonds (as opposed to general obligation bonds) may be preferable for State organizations. Revenue bonds fund projects from their inherent projected and realized savings in energy costs, relying on conventional repayment techniques (in particular lease/purchase agreements).
- The establishment of a State entity to issue revenue bonds for energy conservation in public buildings may require an act of the State legislature. This was found to be the case in South Carolina.
- Establishment of a State bonding authority involves substantial legal and financial expertise. Bond counsel, brokerage services, insurance and other business and professional services will be required.
- Professional input is also necessary for the development of the lease/purchase agreements and vendor agreements by which the bonds will be repaid through energy savings (copies of sample agreements are included in the Operational Manual).

Reports: Project Overview Report,
Operational Manual for a South Carolina Energy Management Finance Authority,
and Third-Party Financing Guide,
The State of South Carolina, June, 1988.

For Further Information on This Project Contact: The Governor's Office of Energy,
Agriculture and Natural Resources
State of South Carolina
1205 Pendleton Street, Suite 333
Columbia, SC 29201

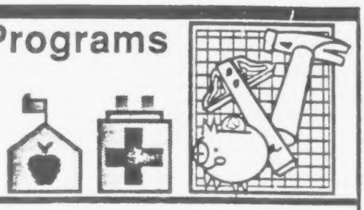
For more information on the ICP, contact:

Institutional Conservation Programs
Office of State and Local Assistance Programs
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

April 1989

Institutional Conservation Programs
State Tier I Project: Vermont

INFORMATION BRIEF



Background

The purpose of conducting the Vermont project, funded under a U.S. Department of Energy Institutional Conservation Programs (ICP) Tier I grant, was to promote long-term energy efficiency in schools by changing the school administrators' perceptions of managing energy use in their buildings. This change of perception was to be brought about by training school administrators, in one-day seminar formats, to use their own energy budgets as resources to increase building energy efficiency, and by providing the tools to enable school administrators to immediately initiate successful energy management programs in their facilities. The training was aimed at the back-to-basics message that energy efficiency is cost-effective, and at showing school administrators that they could manage the energy use and expense in their own facilities.

Goals and Objectives

The goal of the Vermont program training seminars was to teach the following concepts:

- School energy efficiency results in cost savings.
- School energy efficiency can be achieved by a responsible manager who is committed to the result and knows how to fully utilize existing resources (financial, management, technical, and personnel).
- School administrators need to discard the "energy crisis" mentality and dismantle the crisis response measures which were developed over ten years ago.
- A successful energy management effort starts with energy accounting and successful implementation of systems to operate and maintain buildings for the optimum environmental conditions at the least cost.
- The data and technical expertise a manager needs to implement an effective energy management program are available.
- Financing for cost-effective measures is available.

Approach

One-day seminars were held in each of four New England States (Vermont, Connecticut, New Hampshire, and Maine) for school superintendents, principals and school board members. The topics covered by the seminars included:

- Case studies in energy management,
- Money and financing,
- Use of energy accounting and operations and maintenance reports, and
- Data acquisition and computer demonstration of financial information.

In addition to the one-day seminars, a train-the-trainers program was held in conjunction with the Vermont seminar. Energy experts from 26 locations around the country attended the three-day seminar and were supplied with energy management materials, tools, and techniques with which they could return home and teach local school administrators how to conserve energy and save funds.

Key Findings

The evaluation forms provided by the training seminar participants indicate that the training received has been very useful to the school administrators involved. Returns indicated that 33% of the participants had implemented steps recommended in the seminars, and that 50% had used the operations policy and maintenance checklists provided to them. Program evaluations indicated some of the specific measures already implemented include window replacements, energy audits, and rebuilding projects.

The respondents were asked to give an overall rating of the seminar's effectiveness in terms of the impact it has had on school energy and management strategy. The results of the evaluation forms was an overall rating of "3" (where 5 was a "great effect" and 1 was "no effect") for the training programs indicating that most participants received useful information which they can apply to their own energy management tasks.

The project results indicate that the training seminars have been well received. The train-the-trainers seminar held in Vermont had personnel from 26 out-of-State locations. With the knowledge gained at the workshop, the out-of-State trainers then went back to their respective areas to train other officials in energy management techniques. These officials are also available "on-loan" to other regions that did not have a representative at the training seminar.

The tools provided at the seminars, and a sense of how to use them, caused the participating school officials to become more receptive to new ideas. Also, when a new idea is found to be applicable to energy management efforts, it can be passed on through a newsletter that was developed under the project, and is sent to all participants to keep them abreast of recent developments.

Since the Vermont effort was the first in the region to use this type of energy management training approach, several recommendations are made to improve the performance of future programs. These include:

- The financing portion could be made more interactive, with participants sharing problems and concerns about their own financing history.
- Marketing methods could be modified to include front page newspaper articles and prime-time TV news stories.
- Seminars may need to be taken directly to an individual school so that local problems can be targeted.
- The train-the-trainers program could be shortened without content loss through format restructuring.
- The actual computer demonstration portion could be made optional.
- Additional follow-up seminars could be provided.

Report: Developmental State Programs for Institutional Conservation, Grant # DE-FG01-86CE64611.

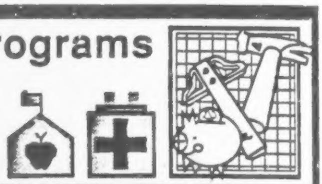
For Further Information on This Project
Contact: State of Vermont
Department of Public Service
120 State Street
State Office Building
Montpelier, VT 05602

For more information on the ICP, contact:

Institutional Conservation Programs
Office of State and Local Assistance Programs
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

April 1989

Institutional Conservation Programs
State Tier I Project: Colorado
INFORMATION BRIEF



Background

The goal of the Colorado Tier I project, funded by the U.S. Department of Energy's Institutional Conservation Programs (ICP), was to investigate the potential to establish energy management as a feature of existing non-profit cooperative buying services (CBS). Public and private non-profit schools and hospitals throughout Colorado belong to CBSs which provide these institutions with assistance in purchasing a range of goods and services. However, energy conservation services are not typically offered.

The ability of CBSs to provide a system for the delivery of conservation services would appear to be a logical extension of their traditional role. It was also anticipated that the impact of the program and its chance for continuation would be enhanced by providing energy management services within the context of the organizational function of existing CBSs. The Colorado Office of Energy Conservation (OEC) proposed to develop this capability by funding the initial costs for selected institutional CBSs to provide energy management services for a period of one year.

Goals and Objectives

The general goal of this project was to establish energy management services as a feature of existing institutional CBSs and to develop measures to provide for their continued funding by their institutional customers. The specific goals of the project were:

- Solicit the participation of selected CBSs and provide funds for a full time energy manager position within these organizations.
- Produce a guidebook on the project for CBSs that did not participate in the project, but that would like to replicate it later.
- Develop an agreement for use by members of the CBSs which would designate a percentage of each institution's energy savings to be pooled to pay for continuing services.

Approach

In order to establish energy conservation services within existing CBSs, the Colorado Office of Energy Conservation prepared and issued a Request for Proposal to the CBSs of the State. The RFP offered to fund 80 percent of the cost of providing energy management services such as:

- Energy audits,
- Operations and maintenance procedures planning, training, and implementation,
- Energy construction and project management, and
- Energy accounting services.

Five proposals were received from the initial solicitation with only one being acceptable. A survey was done to determine the reason for the poor response. It was found that :

- The timing was bad because it coincided with the year end holiday.
- Too much specific information was requested.
- Some of the CBSs stated that if their participating members had wanted this service they would have requested it.

The text of the RFP was rewritten, and from the response three contractors were selected:

- The Arkansas Valley Board of Cooperative Educational Services (BOCES) would offer services to member school districts.

- Hospital Shared Services of Colorado would offer services to hospitals throughout Colorado.
- The Energy Office of Grand Junction would offer services to both schools and hospitals in its area.

Key Findings

The key findings of the project are presented below from the perspective of the Colorado energy office and the three primary participants in the program.

Colorado Energy Office

- Soliciting the participation of existing CBSs proved more difficult than anticipated. The initial RFP failed to generate an acceptable response. A general lack of interest and commitment on the part of the CBSs and their participating members was expressed.
- Added workload appears to be a reason why many institutions refuse to participate in energy management programs. A program to provide energy managers for individual facilities versus larger groups (i.e., CBSs) is recommended to address this problem.
- The need exists to develop new ways to market energy management. Facility managers accept utility bills as uncontrollable. Demonstrated savings are vital to overcoming this attitude.
- Turnover of program personnel impacted project success. Two of the three project energy auditors resigned before their projects were completed.

Arkansas Valley Board of Cooperative Educational Services

- When selecting a program director, make sure the individual has the time to devote to keep the program moving along, in order to avoid stagnation of conservation efforts.
- When selecting an engineer to perform audits, check references and past projects to determine if their qualifications are appropriate to the task.
- Audits were conducted for eight member school districts. It was estimated that each school district could save between 20 and 30 percent of their energy bills if appropriate conservation measures were implemented.

The Energy Office of Grand Junction

- Energy audits and operating and maintenance training were provided to both schools and hospitals in the Grand Junction area. As part of this training, a detailed Building Operators Manual was prepared.
- A seminar was conducted on the potential for significantly reducing natural gas costs through direct purchase. Attendees expressed considerable interest in this concept.

Hospital Shared Services

- Energy audits were performed for 21 non-profit hospitals. However, rural hospitals were reluctant to participate in the energy accounting services offered by HSS because there was a cost for this service.

Report: Developmental State Program for Institutional Conservation, 1988.

For Further Information on This Project
Contact: State of Colorado
Office of Energy Conservation
112 E. 14th Avenue
Denver, CO 80203

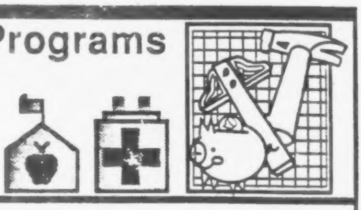
For more information on the ICP, contact:

Institutional Conservation Programs
Office of State and Local Assistance Programs
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

April 1989

Institutional Conservation Programs
State Tier I Project: Ohio

INFORMATION BRIEF



Background

The objective of the U.S. Department of Energy Institutional Conservation Programs (ICP) Tier I grant effort in Ohio was the formation and operation of an association dedicated to the needs of individuals responsible for the operation and maintenance (O&M) of public buildings. Under the direction of the Ohio Department of Development, Community Development Division, the Ohio Public Facilities Maintenance Association (OPFMA) was organized as a registered membership association which provides needed technical information, technical assistance, and training on all aspects of operating a public facility, especially in the areas of energy conservation and retrofit.

Goals and Objectives

The primary objectives of OPFMA are to:

- Establish and maintain sound operational support programs for public facilities,
- Improve, promote, and develop the professional status of public facility maintenance personnel, and
- Urge facility managers to constantly strive to improve their knowledge and skill levels.

OPFMA founders believed a non-profit association could be formed and become self-sufficient by addressing the lack of O&M information and training. In organizing its training functions, OPFMA sought to address several key gaps in O&M training. These included:

- A void in the area of training and technical information for people in the O&M areas of public buildings,
- A lack of reasonably priced training in O&M subjects, and
- The loss of public funds on poorly maintained buildings and other facilities, due to the lack of training dollars available to the public sector.

OPFMA was organized to serve a group of people with common responsibilities from all public sectors. Representative institutional sectors covered by OPFMA include:

- Public and private non-profit schools,
- Hospitals,
- Universities and colleges,
- State agencies,
- Counties, cities, villages, and townships,
- Libraries, and
- Other public buildings.

Approach

The formation of OPFMA required following State regulations and incorporation laws. After establishment, OPFMA went through the process of organizing and performing start-up functions before it could actually start work training O&M personnel throughout Ohio.

OPFMA approached meeting its goals by carrying out several types of outreach programs aimed at the O&M personnel of public buildings. The outreach methods included:

- Publication of a monthly newsletter, entitled "Spotlight on Maintenance," to provide needed technical information on energy conserving O&M procedures and to provide the mechanism for sharing information between members,
- Planning and implementing on-site "how to" training seminars dealing with O&M issues of concern (roofing, heating and air conditioning,

boilers, finance, etc.) to Ohio's public buildings managers,

- Developing a trade show exhibit for participation in appropriate trade shows to publicize the existence and services of OPFMA,
- Sponsoring, planning, and conducting annual conferences for members and non-members of OPFMA for the purpose of sharing the latest knowledge of O&M methods with the conference participants, and
- Maintaining a library of O&M information for members' use.

OPFMA is organized into two levels. The first level, the Board of Trustees, is responsible for the ratification of all policy and operating procedures. The Executive Committee makes up the second level of organization. The Executive Committees' key responsibilities include:

- Overseeing OPFMA finances,
- Hiring administrative personnel,
- Establishing committees,
- Approving service contracts and purchases,
- Setting membership dues and other charges and fees, and
- Acquiring/soliciting additional funds to operate the OPFMA until it can become self-sufficient.

Key Findings and Conclusions

Key findings from this project include:

- OPFMA has been well received in the public facilities community. Evidence of this is found in the active membership of over 400. OPFMA has already held two annual conferences with attendance of more than 500 members and non-members, and planning is underway for the 3rd annual meeting.
- On-site seminars provided by OPFMA have been welcomed in schools and other facilities across the State of Ohio. The program is successful to the point that the list for future seminars continues to grow through the requests of participants and OPFMA members.
- OPFMA has been operating successfully for over two years. It appears that it will continue to operate as a self-supporting organization. OPFMA provides a model for other States wishing to establish training and related services, including technology transfer, for public building O&M managers and staff.

Report: Final Report Grant No. DE-FG01-86CE64612, Developmental State Programs for Institutional Conservation.

For Further Information on This Project
Contact: Community Development Division
Ohio Department of Development
Office of Energy Conservation
State Office Tower
P.O. Box 1001
Columbus, OH 43266-0101

For more information on the ICP, contact:

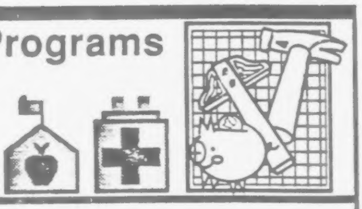
Institutional Conservation Programs
Office of State and Local Assistance Programs
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

April 1989

Institutional Conservation Programs

State Tier I Project: Pennsylvania

INFORMATION BRIEF



Background

The Institutional Energy Efficiency Partnership Project was established, through a Tier I grant funded by the U.S. Department of Energy's Institutional Conservation Programs (ICP), to enhance K-12 school personnel's and attendees' knowledge of energy efficiency and alternative financing opportunities. A broad goal of the project was to expand institutional reliance on non-Federal organizations and private sector resources for technical assistance and energy conservation investment. The program was designed to create a series of partnerships and supportive relationships among fifteen school district demonstration sites, the Pennsylvania energy office (PEO), and the technical and financial resources available to Pennsylvania schools.

A Project Advisory Committee, whose members represented organizations serving the schools or offering technical or financial assistance to Pennsylvania schools, was formed to offer insights from the perspectives of those represented and to provide project guidance. The PEO surveyed approximately 250 Pennsylvania school districts, of which fifty indicated interest in participating in the project. Of these, the PEO selected nineteen districts to receive technical and financial instruction under this pilot scale project.

Goals and Objectives

The goals and objectives of the Pennsylvania Tier I Project were to:

- Enhance institutional staff knowledge of energy efficiency and alternative financing opportunities through technical and financial training programs,
- Provide school administrators with the knowledge, procedures and tools to develop a user-oriented approach to energy financing,
- Identify private and public resources to assist schools in implementing energy conservation,
- Create support mechanisms to provide continuing involvement of private and public entities in assisting schools,
- Develop communications strategies to make other Pennsylvania school and public administrators aware of the successes at the selected sites, and
- Fully document the project's procedures from inception to completion, presenting the information in a format that can be easily replicated.

Approach

The project's success relied heavily on building a project team with a broad range of capabilities and maintaining close supporting relationships with the participating school districts. The team consisted of a project director with experience in school energy matters and alternative financing options; an energy engineer; specialists in communications, finance, and computer programming; and an assistant project director to handle programmatic and logistic issues.

The project was designed in three phases. The first and second phases responded to the need to make school personnel aware of how to use energy more efficiently, the public and private resources available, non-traditional financing to fund energy work, and effective procedures for accessing the resources. The third phase centered on developing internal support for energy programs and ways to communicate results so others might learn how to achieve similar results.

Utilizing the project team, the PEO developed and provided two training programs: 1) a two and one-half day training session and manual on building energy efficiency for facility managers; and 2) a similar indepth session and manual on financing opportunities for fiscal personnel. Other key activities included instruction on and analysis of energy surveys, individualized on-site consultation, and an awards ceremony to recognize the participants' contributions to the demonstration.

Key Findings

An assessment and evaluation of the project indicated the following:

- The project design is a viable model, judging from post-project impression surveys.
- The project indicates that significant savings may be realized with minimal financial outlay. Additionally, various financing options are readily available.
- Involvement of school personnel and district commitment to the project is crucial to the full success of the project.
- The most frequently recommended cost-savings measures were improved lighting efficiency, changes to HVAC controls, domestic hot water modifications, and improvements in building envelope thermal efficiency.
- Through the project, both public and private resources (technical and financial) are being leveraged for use by school districts.
- Among the various project sessions, the energy accounting sessions were rated most valuable by both technical and business officials.
- Barriers to district participation in the project included lack of familiarity with energy efficiency techniques and issues, unwillingness to supply the level of commitment required for project success, and intimidation by the innovative aspects of the demonstration project.

As a result of participation by the school districts and continued interest in the cost savings possible, the project has good potential to continue. In addition, the project has enabled school districts to link with and leverage various funding sources, including savings accrued by implementing the cost-saving procedures identified by the project. The project also identified potential avenues for linkages with other funding options, as well as possible leverage points within the public and private financial sector.

A follow-up survey conducted by the PEO indicated that most participating districts have implemented the applicable low cost/no cost measures. A few districts have implemented the capital cost energy measures recommended in the building surveys. Further program evaluations are planned, with contacts scheduled with the participating districts for the next year.

Report: Final Federal Assistance Program Status Report for Pennsylvania's Demonstration Grant, DE-FG01-86CE64606

For Further Information on This Project
Contact: Pennsylvania Energy Office
116 Pine Street
P.O. Box 8010
Harrisburg, PA 17105
(717) 783-9981

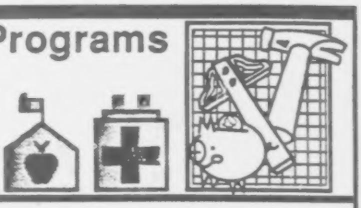
For more information on the ICP, contact:

Institutional Conservation Programs
Office of State and Local Assistance Programs
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

April 1989

Institutional Conservation Programs
State Tier I Project: New Mexico

INFORMATION BRIEF



Background

New Mexico's Energy, Minerals, and Natural Resources Department (EMNRD) established this Tier I project funded by the U.S. Department of Energy's Institutional Conservation Programs (ICP) to supplement available federal funds for institutional conservation programs with public and private sector resources to the maximum extent possible. The project was structured as a pilot program targeted to the small public school districts in New Mexico. This sector is one that traditionally lacked the technical and financial resources to participate in the ICP program.

The pilot project was designed for the needs of the target audience with the provision that the project provide testing and development of project concepts that can be expanded to all institutions eligible for ICP participation. The New Mexico project included financial counseling, energy management training, development of partnerships to share information and services, development of organizational networks, and pooling of capital to provide alternate financing opportunities. Significant spin-off programs include an energy maintenance "circuit rider" program, "mini-grant" program, and an energy efficient design program.

Central to the project were individualized energy audits and equipment maintenance training for school staffs. The energy engineering subcontractors performed these aspects of the project. The subcontractors performed a variety of technical assistance tasks, including developing presentations and training sessions, developing training materials in conjunction with EMNRD, and assisting in follow-up maintenance training and development of training programs and materials.

Goals and Objectives

EMNRD's principal goal was to develop and implement an innovative program to increase energy efficiency in the institutional building sector. To supplement the limited resources available, EMNRD established the following program objectives:

- The program must be designed to involve, on a continuing basis, other public and private sector resources to the maximum extent possible.
- Program activities undertaken must be replicable and therefore fully documented from inception to completion by the project team.

Approach

EMNRD invited all 50 New Mexico public school districts that had an average daily attendance of less than 1000 students to participate in the program. Although less than one percent of these school districts had participated in the ICP grant program since that program began 10 years ago, 40 of these districts accepted the invitation to participate in the Tier I project.

The Tier I project was a dynamic program in New Mexico in the sense that activities were constantly being modified as methodologies were refined and new opportunities were identified. By the time the program ended, a variety of strategies had been used to implement the program, including:

- Establishing partnerships with four educational organizations to deliver services,
- Providing energy evaluations of school buildings and equipment,
- Providing energy management training for school staff,
- Providing financial counseling for energy efficiency improvements,
- Establishing networking and "heroes" projects to promote energy efficiency successes, including a 46-page booklet describing successful projects,
- Developing and demonstrating state-of-the-art computerized preventative maintenance software programs,

- Providing "mini-grants" as seed money for energy efficiency improvements,
- Establishing an energy maintenance "circuit rider" who visits each school on a regular basis,
- Providing design assistance to help ensure that new construction projects are energy-conscious, and
- Providing energy education curriculum materials for students.

Key Findings

Key findings of this project were as follows:

- The vendors reported that, in general, the school facilities appear to be well maintained. However, the vendors also reported that a significant number of custodial staff do not have sufficient technical training to carry out certain tasks. Training was identified by vendors as the most important element of the project.
- The project developed and relied on partnerships with other State organizations, received technical assistance from individuals in other organizations, and procured training materials developed by other State programs and professional organizations. During the reporting period, superintendents at the 40 public school districts participating in the project requested individual meetings to discuss financial strategies for implementing energy improvements recommended under the ICP Tier I project.
- EMNRD developed a plan to allocate oil overcharge funds to a revolving loan fund targeted to public school districts. However, EMNRD identified legal and institutional issues which discouraged participation. A provision of the State Constitution may limit the participation of schools in loan programs. Study is continuing on this issue.

Report: Final Technical Report, Department of Energy Grant No. DE-FG01-86CE64615, "Developmental State Programs for Institutional Conservation Programs."

For Further Information on This Project
Contact: Energy, Minerals and Natural
Resources Department
State of New Mexico
525 Camino de los Marquez
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Institutional Conservation Programs
Office of State and Local Assistance Programs
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

April 1989

Institutional Conservation Programs

State Tier I Project: Nebraska

INFORMATION BRIEF

Background

In order to increase the efficient use of energy in Nebraska's public and institutional buildings, the Nebraska Energy Office, under a Tier I grant from the U. S. Department of Energy's Institutional Conservation Programs (ICP), developed a series of program and financing options to encourage energy efficiency in their public and public-purpose institutions. The programs designed by this project reinforce the importance of merging sound energy management with adequate and available financing for energy efficiency improvement projects.

The declining availability of tax revenue for capital improvements has necessitated the broadening of the search for financing especially for energy efficiency improvements. The project examined several alternative financing approaches. The identification of alternative funding sources involved the creation of a task force whose goal was to develop workable programs with the political consensus required to implement State-funded financing options.

The Nebraska Energy Office conducted research to identify the major constraints to the implementation of energy efficiency projects and the potentially most cost effective incentives and promotional approaches to encourage program participation. Interviews with municipal, county, school district and health care institutions found that the potential users of the Institutional Conservation Program (ICP) are:

- Unaware of the potential benefits of energy efficiency improvements,
- Unclear about designing and implementing such improvements,
- Skeptical of claims of the financial benefits, and
- Conservative about speculatively incurring costs.

Goals and Objectives

The goals of the Nebraska Public Buildings Program were to:

- Develop a comprehesive approach to implementing energy improvements in institutional buildings,
- Increase awareness in all Nebraska institutions of the benefits of energy management and energy improvements,
- Identify funding sources, either public or private, available to Nebraska institutions to make energy improvements,
- Increase the Nebraska Energy Office's base of information on Nebraska's public buildings, and
- Develop a political consensus on the need to improve the efficiency of Nebraska's institutional buildings.

Approach

The programs developed under the Tier I grant reflect a comprehensive approach to address the energy needs in the public sector. The four major components of the Nebraska Public Buildings Program are:

1. Resource Distribution

- Development of a resource library,
- Creation of a technical and financial counseling service,
- Publication of an Energy Calculation Handbook and software, and
- Development of marketing strategies.

2. Networking

- Creation of a data bank of buildings,
- Presentation of awards to honor energy conservation achievement, and

- **Association outreach to the staff of trade association allies.**

3. Financing Sources

- Through the efforts of a 23-member task force, representing a cross section of interests and energy expertise, workable designs for financing options have been developed. The recommendations of the task force have been forwarded to Governor Kay Orr. This component of the project involved the most time consuming, and perhaps the most important, work of the Nebraska Public Buildings Energy Program.

4. School Weatherization Program

- This component of the project involved a thorough review of the existing school weatherization program and its revolving loan fund to formulate improved programs for financing and marketing energy improvement projects in the institutional sector.

Although the Nebraska Energy Office has developed and tested each of the project options, it has not yet implemented the entire program. Rather, selected options have been implemented which best fit current operations and budgets.

Financing Options

The financing options recommended by the task force are segmented by constituent sector and are self-funding. The options developed by the task force would have to gain the administrative and legislative approval necessary for their implementation. Specific financing options developed by the project include:

Financing Options for State Facilities

- A revolving loan fund capitalized by State appropriations and administered by the Task Force for Building Renewal, and
- Nebraska Energy Corporation, a private non-profit authority created by the legislature to issue revenue bonds to finance the lease purchase of energy efficiency projects for State facilities.

Financing Options for Local Government Facilities

- A revolving loan fund capitalized by oil overcharge funds or State appropriations to be administrated by the Nebraska Energy Office, and
- A pooled bonding authority for local jurisdictions to join together to issue bonds and use the proceeds to finance energy improvements (Note: This would require legislative authorization).

Financing Options for Private Nonprofit Organizations

- Private colleges and hospitals could be made eligible for loans from the revolving fund described above for local jurisdictions, and
- The Nebraska Educational Facility Authority (NEFA) has expressed an interest in issuing a pooled bond fund specifically targeted at energy efficiency improvements in private colleges.

Report: Nebraska Public Buildings Energy Program, July, 1988

For Further Information on This Project
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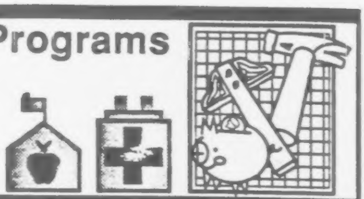
April 1989

Institutional Conservation Programs
State Tier I Project: Wisconsin

INFORMATION BRIEF



Background

The Wisconsin Preventative Maintenance, Repair, and Operational Services (PROS) Pilot Program, funded by a U.S. Department of Energy Institutional Conservation Programs (ICP) Tier I grant, resulted from the realization by several south central Wisconsin school districts that the need existed for improved energy management and maintenance practices. Development of the PROS pilot program began in January, 1986, with a meeting of several school district representatives - the Wisconsin Department of Public Instruction (DPI) and others - to discuss ideas for improving facility management in schools. A membership fee charged to each participating school was to cover the costs of PROS services.

Goals and Objectives

As part of the DOE ICP Tier I grant program, the Wisconsin PROS Pilot Program was designed and promoted as an overall building management program in which information on, and costs of, building conservation retrofits and improvements could be shared throughout a school district. The PROS program chose school building management because prolonged life of school facilities is a prime concern of school officials, as very few new schools are being approved by Wisconsin voters. The goals of PROS include:

- Increasing and sustained energy savings for school districts,
- Protecting the substantial energy conservation investments made by DOE, State government, and school districts,
- Increasing adoption of formal energy management planning and preventative maintenance practices in institutional buildings,
- Increasing utilization of innovative mechanisms for financing energy improvements, and
- Opening lines of communication with other organizations and building sectors that can benefit from increased energy savings.

Approach

The approach that PROS used to accomplish the task of increasing the energy management knowledge of institutional building personnel included:

- Having PROS personnel act as an energy manager for each school district (providing regular inspection, recordkeeping, repair and preventative maintenance),
- Providing a detailed assessment of each building's maintenance program and customized manuals detailing how the building can be operated more efficiently (these documents are entitled, "Building Condition Observation Surveys" (BCO), and "Building Operations Manuals" (BOM)),
- Providing on-site, customized training and technical assistance for maintenance staff on new and existing equipment, roofs and other school facility components,
- Maintaining regular surveillance and identification of building operations and maintenance procedures,
- Monitoring and reporting changes in energy use and cost savings,
- Sponsoring seminars and individual consultations regarding financing and innovative budgeting for energy conservation improvements, and
- Allowing for volume purchasing of maintenance materials, parts and supplies for schools within the participating PROS district.

Key Findings

Key findings resulting from the establishment and operation of PROS on a pilot scale include:

- Initial pre-program contacts with school districts presented a falsely optimistic scenario of potential PROS program participation. Many of the school districts that showed initial enthusiasm for the PROS program had to decline participation because the request for funds (participation fee) from them was too late in arriving to meet their budget process timeline.

- Initiation of the PROS program did result in a large group of Wisconsin building owners and companies sharing in a networking system for exchange of energy conservation information. Examples of organizations networking in response to PROS are:

  - The Wisconsin Association of School Boards,
  - The Wisconsin Division of State Facilities Management,
  - The Wisconsin Power and Light Company,
  - The Wisconsin Association of School Business Officials, and
  - The League of Wisconsin Municipalities.

- Some operational difficulties became apparent during the course of the project. These included:

  - Operating the project during the first year included delays in training document development. This resulted in energy savings measurements at schools being made after the critical winter heating season had passed.
  - Financial difficulties with contracted firms delayed school contributions and prevented the PROS project from attaining self-sufficiency.

According to PROS sponsors, the PROS project, if properly managed, has the potential to assist with the energy management of many types of buildings. PROS currently operates through a group of school districts called a Cooperative Educational Service Agency (CESA). There are presently 38 States with such groups operating in ways similar to Wisconsin where a PROS-like project could be tested.

To achieve this there are several changes which may improve the performance of the PROS project. According to Wisconsin Division of Energy staff, these include:

- Better management of building information document production so as to ensure its availability and usefulness at the appropriate time of year,

- Perfecting a plan for attaining program financial self-sufficiency based on reliable financial data, and

- Better business management of the structure. The business aspects associated with the program need to be carefully planned and integrated into the host organization's financial structure.

Report: Wisconsin Preventative Maintenance, Repair, and Operational Services (PROS) Pilot Program Final Report. ICP Tier I Grant #DE-FG01-86CE64609.

For Further Information on This Project
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For more information on the ICP, contact:

Institutional Conservation Programs
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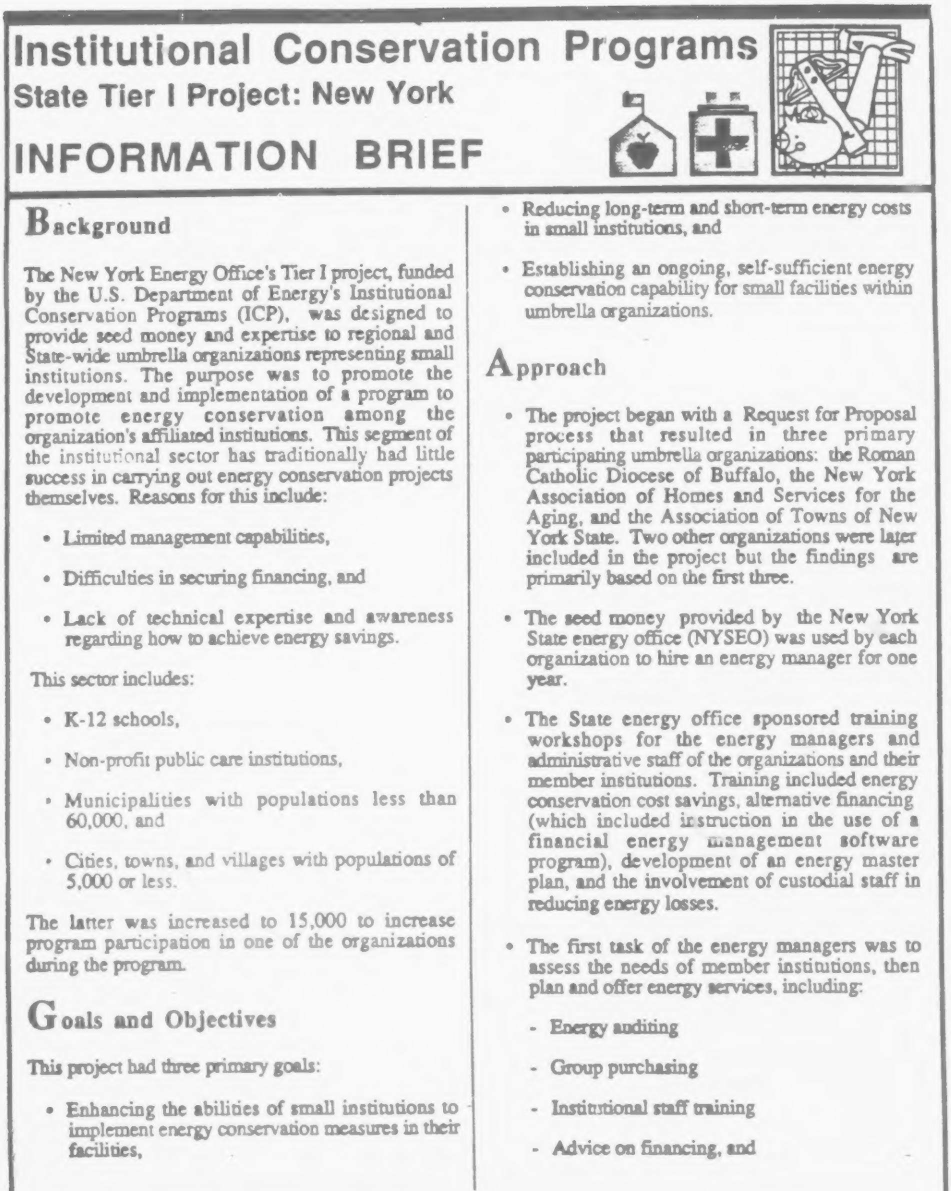
April 1989



Institutional Conservation Programs

State Tier I Project: New York

INFORMATION BRIEF

Background

The New York Energy Office's Tier I project, funded by the U.S. Department of Energy's Institutional Conservation Programs (ICP), was designed to provide seed money and expertise to regional and State-wide umbrella organizations representing small institutions. The purpose was to promote the development and implementation of a program to promote energy conservation among the organization's affiliated institutions. This segment of the institutional sector has traditionally had little success in carrying out energy conservation projects themselves. Reasons for this include:

- Limited management capabilities,
- Difficulties in securing financing, and
- Lack of technical expertise and awareness regarding how to achieve energy savings.

This sector includes:

- K-12 schools,
- Non-profit public care institutions,
- Municipalities with populations less than 60,000, and
- Cities, towns, and villages with populations of 5,000 or less.

The latter was increased to 15,000 to increase program participation in one of the organizations during the program.

Goals and Objectives

This project had three primary goals:

- Enhancing the abilities of small institutions to implement energy conservation measures in their facilities,
- Reducing long-term and short-term energy costs in small institutions, and
- Establishing an ongoing, self-sufficient energy conservation capability for small facilities within umbrella organizations.

Approach

- The project began with a Request for Proposal process that resulted in three primary participating umbrella organizations: the Roman Catholic Diocese of Buffalo, the New York Association of Homes and Services for the Aging, and the Association of Towns of New York State. Two other organizations were later included in the project but the findings are primarily based on the first three.
- The seed money provided by the New York State energy office (NYSEO) was used by each organization to hire an energy manager for one year.
- The State energy office sponsored training workshops for the energy managers and administrative staff of the organizations and their member institutions. Training included energy conservation cost savings, alternative financing (which included instruction in the use of a financial energy management software program), development of an energy master plan, and the involvement of custodial staff in reducing energy losses.
- The first task of the energy managers was to assess the needs of member institutions, then plan and offer energy services, including:
  - Energy auditing
  - Group purchasing
  - Institutional staff training
  - Advice on financing, and

  - Advice and assistance in the applying for and managing of energy grants received under the ICP program.

- At the end of the program, the organizations submitted a plan for continuing services on a self-supporting basis.

Key Findings

Key findings under this project include:

- Results of an initial needs assessment survey completed by the organizations' member institutions indicated a strong interest in energy conservation training workshops.

- Organizations with strong administrative or financial control over member institutions have greater potential for self-sufficiency with this type of program. Of five organizations participating in the program, only one achieved self-sufficiency. In addition, the organizations without this control had less institutional participation in the program due to the need to recruit participants.

- Direct communication with institutional personnel is more effective than mailings or phone communication in recruiting participants. When an energy manager or NYSEO program manager spoke at an umbrella organization's conference, many more referrals for program services were produced. In addition, on-site visits were conducted to promote the program and conduct energy audit walk-throughs to point out low-cost/no-cost conservation methods. These visits maintained the impetus of the program and helped resolve energy loss problems. During such visits, visual presentation of building losses was very effective in motivating energy conservation actions.

- The initial funding level of $30,000 per umbrella organization was inadequate to cover the energy manager's salary and expenses. The organizations tended to assign about 25% of the funding to expenses, the remainder being inadequate to attract an experienced energy manager.

- The one year program duration did not allow sufficient time for energy conservation gains to be realized and evaluated.

- Small institutions preferred the ICP grant process to alternative financing such as low interest loans or energy performance contracting. This was the case despite extensive training in the use of financial energy management software and other alternative financing training.

Report: Small Institutions Energy Program Assistance Final Report, December 1988

For Further Information on This Project, Contact:
New York State Energy Office
Division of Conservation
2 Rockefeller Plaza
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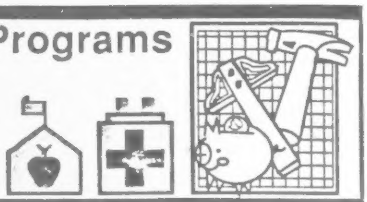
April 1989

Institutional Conservation Programs
State Tier I Project: Oklahoma

INFORMATION BRIEF



Background

The Energy Conservation Partnership Program for Oklahoma's health care industry was funded by a U.S. Department of Energy Institutional Conservation Programs (ICP) Tier I grant. The project was to provide educational training and financial assistance in the areas of energy conservation, energy management, and alternative financing arrangements to Oklahoma's hospitals. Hospitals were targeted because it was perceived that energy conservation in the health care facilities area was not as high a priority as it should be. Also, many hospitals were built when energy costs were low, and with today's higher energy prices it is necessary to look at possible ways of reducing the number of dollars spent on energy. Oklahoma's project attempted to address this issue through establishment of a conservation information network, training workshops for hospital administrators and others so they could become up-to-date on energy conservation information, and identifying alternative financing methods to cover the costs of new or retrofitted energy use systems.

Approach

The first step in implementing the Conservation Partnership Program was to survey all the potential participating hospitals. Research was conducted into various aspects of running a hospital. A resource book was prepared detailing hospital cost and energy use data. The resource book includes the following data elements for each Oklahoma hospital surveyed:

- Hospital square footage,
- Number of beds,
- Patient days,
- Energy consumption,
- Cost of operation per bed,
- Cost of operation per square foot,
- Cost per patient day, and
- Percentage of annual budget spent on energy costs.

These data were to be used to select hospitals which would benefit the most from additional conservation programs.

Key Findings

It was found that the type of hospital data contained in the resource book was difficult and time consuming to collect, resulting in a significant delay in the project. While an extension and revision of the project was not approved, the data are proving to be very valuable in analyzing the potential for energy conservation in the hospital sector.

Report: Oklahoma Tier I Program Synopsis,
April, 1989.

For Further Information on This Project
Contact: Oklahoma Department of Commerce
Division of Community Affairs and
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6601 Broadway Extension #5
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May 1989

State and Local Programs - State Assistance

Question: In the State Energy Conservation Program: Are States required to establish energy emergency plans and capability under this program?

Answer: No, under current legislation and regulations, States are permitted to use program funds for emergency planning function, but are not required to do so.

State and Local Programs - Program Direction

Question: The 1991 budget apparently asks for support of 193 FTEs in 1991 while the 1990 budget supports only 180 (p.445). Why are more people required if you are reducing the program substantially?

Answer: In 1990, as in prior years, the program has been supported not only by the individuals directly charged to the program, but also by people currently assigned by and charged to the Department's Operations Offices, who have been providing administrative support services vital to program operations. To properly charge those additional 46 FTEs directly to this program, it was decided to include them in this portion of the budget request. We are requesting 147 program staff in FY 1991 which is sufficient to meet the needs for program oversight and monitoring, focusing primarily on PVE-funded activities.

Question: Why are you reducing funds for information dissemination when in most other areas of your budget they are increasing, including your "Campaign" for near term conservation?

Answer: Although State and Local Program's funding for contract support for information dissemination would be reduced in FY 1991, we look forward to increasing the effective amount of information disseminated, through efficiency gained and through cooperative efforts with the end-use technology programs. This goal is emphasized in the reorganization of Conservation and Renewable Energy, which transfers responsibility for specific technology transfer programs - along with the resources for carrying out those responsibilities - from various parts of the old organization into the new Office of Technical and Financial Assistance.

State and Local Programs - Program Direction

Question: How much is included for energy emergency planning for States in 1991?

Answer: The resources available to the States under the petroleum violation escrow funds may, at a State's option, be used for energy emergency planning. Because the level of funds available is more than sufficient to meet anticipated State need, no additional funds are sought in the FY 1991 Budget Request.

Question: Is this [energy emergency planning] the same activity included in the State Energy Conservation Program in prior years?

Answer: Yes, it is. However, if H.R. 711 is enacted as proposed, the submission to DOE of an energy emergency plan would become mandatory for the States under the State Energy Conservation Program.

State and Local Programs - Program Direction

Question: If overall funding is restored to 1990 levels, are there sufficient contractual service and monitoring funds provided in the 1991 budget?

Answer: Regardless of the level of overall funding for these programs, the need for contractual services to support information dissemination will be less than in FY 1990 because the resources associated with a number of technology transfer programs will be leveraged in FY 1991 to serve this function. Contractual services for monitoring and other functions will be sufficient as requested in FY 1991, even if the programs are funded at FY 1990 levels, because our request assumed that the programs, with no FY 1991 funding, would still not close down until all prior year funds had been fully expended - in most cases well after the end of FY 1991.

Question: If not, what additional funds would be needed for what purpose:

Answer: As the answer to C601 clarifies, no additional funds for contractual service and monitoring would be needed.

Question: Why is increased travel funding required in FY 1991?

Answer: Increased travel funds are requested in FY 1991 for two reasons. First, we are proposing that administrative support personnel formerly charged to the Department's Operations Offices, but who are providing full-time essential support for these programs, should be funded under our appropriation directly, and travel funds are required for these persons' trips to perform administrative types of grantee monitoring, attend meetings, and conduct training for grantees. Second, to make best use of the leveraged resources associated with specific technology transfer programs, including international information programs, more travel funds will be required in FY 1991.

Policy and Management

Question: The number of personnel identified in policy and management decreases from 21 to 13 FTEs in 1991 yet costs increase (p. 453). Please explain this.

Answer: The FY Congressional Request includes sufficient funging for the salaries and related expenses of the full existing complement of Policy and Management staff and the annual salary comparability raise.

Question: Provide a listing of current contractors and functions under the contractor support area.

Answer: The following list reflects current contractors and their respective functions.

Contractor	Function
1. CSR, Inc.	Assists the Assistant Secretary and his immediate offices by providing administrative and clerical support for planning, budget, and evaluation processes impacting Energy Conservation programs.
2. KOH, Inc.	Provides on-site support for CE mail and messenger services.
3. Solar Energy Research Institute (SERI)	Provides technical information materials related to the National Energy Strategy such as modelling and data collection efforts.
4. Computer Data Systems, Inc. (CDSI)	Provides for maintenance of automated data processing (ADP) equipment such as software upgrades, repair and installation of hardware, training, hotline support, etc.
5. SRA Technologies, Inc.	Provides on-site support for CE public hearings and docket file assistance associated with formal rulemakings.

Question: The SBIR program has two conflicting funding allocations on page 452 for 1991. Which allocation is correct?

Answer: The FY 1991 Congressional Request includes $1,150,000 to support the SBIR based on R&D included in the Request.

General

Question: Please provide a substantive description of work proposed for analysis and technology transfer activities in 1991, particularly where there is a change in emphasis or an increase in requested funding.

Answer: We envision 1991 to be the stepping stone to a vastly more effective system for technology transfer for years to come. We have set the foundation for this by reorganizing the Office of Conservation and Renewable Energy along end-use sector lines and by establishing a central locus for public outreach and technology transfer programs within the new Office of Technical and Financial Assistance. That office is spearheading the establishment of inter-organizational Technology Transfer Teams, which will begin by defining a set of concrete actions that can be launched in FY 1991 supporting the primary energy efficiency and renewable energy initiatives. These actions will utilize the existing State and local networks and other infrastructural assets that have been built in connection with the national energy conservation grant programs, to move information on existing technologies from the developers to the end-users. Also in FY 1991, existing technology transfer programs such as CAREIRS, STIP, CORECT, CADDET and NATAS will be further mobilized in a concerted drive to meet our technology transfer mission.

Alternative Budget

Question: Various interest groups have submitted an Alternative Budget for Energy Conservation, FY 1991.

> In Energy Conservation Research and Development please rank in priority sequence the initiatives suggested by the groups. Do not rank buildings, transportation, industries, or multi-sector separately, but combine all sectors for priority purposes.

Answer: Because of the nature of this question, DOE first wants to note that the Administration's budget request is a considered statement of priorities and represents our preferred allocation of Federal funding for 1991. The following answer is provided to be responsive to the Committee's request and to provide some insight into a broader range of possible future activities.

The Alternative Budget for Energy Conservation proposes 41 new initiatives, distributed among four subprograms:

Building Sector	23*
Transportation	9
Industry Sector	4
Multi-Sector	5

* Not including $5 million for Building Standards and Implementation Demonstration, which is listed as a new initiative, but is already in DOE's budget request.

The Alternative Budget includes three initiatives that could be useful but should be part of the activities of the Energy Information Administration (EIA), rather than CE. These initiatives are:

National End Use Data and Analysis Center (Buildings)
National Center for Data on Alternative Fuels (Trans.)
Reducing Barriers to Efficient Use of Energy (MS)

These activities could strengthen the data and analysis that provide that fundamental strategic framework for the conservation and renewable program.

We would rank the remaining initiatives in the following order:

1. Four initiatives that would expand the efforts to develop alternatives to chlorofluorocarbons (CFCs):

   Advanced Desiccant Cooling Concepts
   High Efficiency Appliances & Heat Pumps with CFC Alternatives
   Reducing CFC Use in Auto Air Conditioning
   Broadening the Application of Advanced Vacuum Insulations

2. Three initiatives that would stimulate the development of advanced batteries:

   Sodium/Sulfur Ceramic Electrolyte Battery
   High Power Density Sodium/Sulfur Battery
   Rechargeable Sodium and Lithium Battery

3. Two initiatives that would strengthen DOE's activities in indoor air quality:

   Critical Factors for Healthy Buildings
   Expanding the Indoor Air Quality Research Program

4. An additional expansion of the Federal Energy Management Program beyond the increase already being requested:

   Federal Energy Management Program

5. Four initiatives that would expand DOE's participation in industrial and transportation ceramics development and commercialization:

   Continuous Fiber Ceramic Composite (Industry)
   Ceramics in Stationary Gas Turbine (Industry)
   Ceramic Gas Turbine for Trucks (Transportation)
   Advanced Metals Evaluation: Cost Effective Ceramics for
     Cars and Trucks (Transportation)

6. Three initiatives designed to encourage energy efficient windows and homes:

   Home Energy Ratings and Energy Efficient Mortgages
   Fenestration Rating Systems
   National Voluntary Residential Energy Efficiency Program

7. Support for the second automotive gas turbine and related research:

   Automotive Gas Turbine

8. An expansion of the DOE activity in industrial housing:

   Industrialized Housing and Housing Technology Adoption

9. The remaining two industrial sector initiatives:

   Innovative Heat Recovery Process Technology
   Agriculture Energy Use

10. The remaining transportation initiative:

    Heavy Duty Transport (Adiabatic Diesel)

11. Two initiatives that are included under the Multi-Sector Subprogram, but have applications throughout the energy efficiency programs:

    Conservation and Renewable Energy Fellowships
    Energy Conservation and Renewable Energy Technologies for
      Developing countries and Eastern Europe

12. Expansion of the exploratory work on urban heat islands, focusing on the quanitification of causal factors and the assessment of the potential of mitigation strategies:

    Urban Heat Islands Mitigation

13. Four building equipment initiatives:

    Oil Heating Research
    Electric Thermal Storage Heat Pump Supplement
    Commercialization of Advanced High Frequency Lighting
    Advanced Gas-Fired Heat Pumps and Chillers

14. Four of the remaining building sector initiatives:

    SuperWindow Development
    Thermal Distribution
    Advanced Energy Analysis and Design Technologies
    Toward 2000: Adv. Energy Technologies for Existing Buildings

15. The remaining Multi-Sector initiative:

    Planar Solid Oxide Fuel Applications Demonstration

16. The remaining Building Sector initiatives:

    Dynamic Building Envelopes
    Efficient Systems and Components
    Improved Building Process
    Testing, Commissioning, and Demonstration of Advanced
      Technologies

General

Question: For each program direction area please provide the staffing level and the additional funds required in FY 1991 to meet employment floors

Answer: The following data reflects the employment floors for each program direction area and the funding requirements:

Program Direction Account	Employment Floor	FY 1991 Congressional Request	Additional Funding Requirements
1. Buildings and Community Systems	61	$ 3,681,000	$0
2. Industry	35	2,100,000	0
3. Transportation	36	2,300,000	0
4. State and Local Assistance Programs	180	15,000,000	0
5. Multi-Sector	19	1,175,000	0
6. Policy & Mgmt.	21	3,467,000	0
Total....................	352	$27,723,000	$0

QUESTIONS SUBMITTED BY CONGRESSMAN RALPH REGULA

Question: The fiscal year 1990 House report directed the Department to complete a comprehensive continuous fiber composite research and development plan. The plan, with financing options, was to be forwarded to Congress no later than May 1, 1990. While that report has not yet been delivered to Congress I understand that a draft has been prepared. What level of funding does that report recommend for fiscal year 1991?

Answer: The plan is under review. Until that review is completed and the plan is finalized, we do not have funding recommendations other than what is in the FY 1991 Budget Request. The request includes $2.2M for continuous fiber ceramic composites.

Question: It is my understanding that the Department met with representatives from industry earlier this year to discuss a draft of this report. Comments I have received from industry were complimentary of the Department's effort. What is the status of this plan?

Answer: The Plan was revised subsequent to the meeting with the representatives from industry to incorporate many of the changes they recommended. The revised draft was circulated for preliminary review within DOE and additional changes were made. The plan began mandatory concurrence reviews on May 14, and will be delivered to Congress by 15 June 1990.

Question: Can you elaborate on your interaction with industry on this report?

Answer: Three meetings with industry were held in early 1989 to define the basic technical scope of the plan. During those meetings, industry and university experts working with DOE and National Laboratory personnel identified the major tasks and subtasks needed to develop the CFCC material technology. During the writing of the plan, industry personnel helped identify the applications, provided information and leads to help appraise foreign capability, and helped identify key management issues with respect to industry participation.

Question: A draft report on this initiative presented to industry estimated that, by the year 2010, "higher temperature, more efficient processes could reduce industry's annual energy consumption by 6.2 quads." Of this amount the report indicated that readily identifiable applications could result in annual savings of 0.7 quad and an additional 0.4 quad could be accomplished through the use of CFCCs in power generation. If the plan is fully funded, how close will we come to those goals?

Answer: Development of CFCCs would provide the technical capability to achieve the 0.7 and 0.4 quad savings. Obtaining the full benefit of CFCCs will take years and major capital investment on the part of U.S. industry. The 6.2 quad figure referred to all types of higher temperature, more efficient processes, not just CFCCs.

Question: What additional needs to occur to ensure this goal is attained?

Answer: U.S. industry must aggressively commercialize the technology that results from this program.

Question: How will this goal change if the plan is not fully funded?

Answer: The goal will not change. Industry may have to provide more of the development fund, or CFCC components for industrial applications may not be developed as rapidly.

Question: Please differentiate between the long term potential of energy savings of 6.2 quads; the near term savings of 0.7 quad of readily identifiable applications; and the 0.4 quad from the use of CFCCs in power generation.

Answer: The 6.2 quads are the projected energy savings possible through the use of all possible energy conserving technologies, not just those based upon CFCC components. The 0.7 quads are the projected energy savings of the HiPHES (High Pressure Heat Exchange Systems) technologies. This energy savings would be obtained by applications that are likely to rely on CFCC components for their success. The 0.4 quads are the projected energy savings from the use of CFCC components in stationary turbines.

Question: In addition to energy consumption savings, the draft report identifies potential NO_x reductions estimated to be 0.6 MM ton/year from reduced fuel use and CFCC-enabled pollution-abatement products. As Congress continues to debate revisions to the Clean Air Act, this annual 9% reduction of current total NOx emissions per year from U.S. industry and electric power generation is extremely important. If the program plan is fully funded, how close will we come to attaining this goal.

Answer: If the technology is developed and if industry makes the capital investments required, projected NO_x reductions should be achieved.

Question: What additional needs to occur from industry and the government to ensure this goal is attained?

Answer: Industry must aggressively commercialize the resulting technology.

Question: How will this goal change if the plan is not fully funded?

Answer: The goal will not change. Industry may have to provide more funds, the development may take somewhat longer, or industry may import some of the components.

Question: If Congress provides the necessary funding for the program in FY 1991, would the Department include the next increment in your FY 1992 budget?

Answer: The process of development for the FY 1992 budget includes consideration of the CFCC Plan. Final determination of the actual content will be subject to analysis of relative benefit across all major programs.

Question: One of the requirements of the study was an analysis of the financing options. Can you briefly discuss the options under consideration?

Answer: Options range from no additional funding beyond the FY 1991 request ($2.2M) to an all out program of over $90M in total cost. The plan is under review. Until that review is complete and the plan is finalized, we do not have formal options that we can present. The Federal cost for each option that we present will depend not only on the total activity level chosen for that option, but also on the amount of industry cost-sharing that can be anticipated.

Question: Will the Department recommend a preferred option?

Answer: The report will include several funding options. Any recommendation on funding will be included in the FY 1992 budget request.

Question: The industry cost share for Energy Conservation averages from 11% direct cost share in the Building program (plus 12% in-kind) to a 25% cost share in the Industrial program. What level of industry cost share do you contemplate in this plan?

Answer: Industry cost share will be determined in a competitive process. Since the program would be developing and demonstrating specific commercializable products, we would expect that cost sharing to be high -- probably a minimum of 20% in industry contracts, growing to 50% in the later stages of development.

Metals Initiative

Question: Your budget requests $8.6 million for the Metals Initiative in fiscal year 1991. The American Iron and Steel Institute (AISI) has testified on behalf of a $9.5 million program. What work would not be accomplished at the lower funding level?

Answer: The funds requested in the FY 1991 budget, $8.6 million, contain $6.0 million for the AISI Direct Steelmaking project. AISI has testified on behalf of a $9.5 million program of which $7.5 million is for the direct steelmaking project and $2 million for a proposed project in the area of intelligent processing. The FY 1991 request, $6.0 million, for direct steelmaking is consistent with the current cooperative agreement. AISI is negotiating to receive a higher level of funding for the direct steel-making process than is planned in the signed cooperative agreement. The FY 1991 request did not contain funding for the proposed project on intelligent processing, which has not yet been submitted to the Department, and which has not been peer reviewed.

Question: $2,184,000 was allocated for electromagnetic casting research at Argonne National Laboratory. This project has been terminated. Were there any useful results from this project?

Answer: The achievements and useful knowledge gained during the course of this project include:

- A greater understanding of magnet design characteristics necessary for levitation and confinement of liquid metal streams.

- The design and fabrication of a test magnet for the purpose of levitating a sheet of liquid metal. Limited testing demonstrated the existence of instability problems associated with this technology.

- Demonstration of the feasibility of using electromagnetic forces to overcome the surface rippling effect from gas cooling of the liquid metal sheet.

Several patents were issued as a consequence of the technical developments made during this effort. These developments formed the basis for a privately-funded, follow-on effort by Argonne National Laboratory to develop an edge containment system for a consortium of domestic steel companies working in the area of near net shape casting. A commercial firm is now using the technology to produce equipment for the consortium to advance this work further.

Question: Of the $30 million appropriated thus far for the metals initiative approximately $3.8 million remains unobligated for new proposals. What types of new proposals are you planning to fund with this money and when do you anticipate obligating these funds?

Answer: It is anticipated that the unobligated funds will be obligated in FY 1990 to support research in two areas; titanium diboride/graphite cathodes for the Hall-Heroult alumina reduction cell, and near net shape casting of steel sheet and strip.

Question: You are currently supporting a two phased superplastic steels project at Lawrence Livermore Laboratory. What is DOE's involvement in the project and why do you assume that DOE support will not be needed for Phase IIB of this project?

Answer: DOE and industry fully supported Phase I of the superplastic steel processing project, which was concluded early in FY 1990. Industry chose to divide Phase II into two key segments, Phases IIA and IIB, separated by a go/no-go milestone. DOE concurred with this decision, and committed FY 1990 funds to support Phase IIA, subject to signing of the holding company agreement. No commitment has been made by either DOE or industry, at this time, regarding support of Phase IIB.

Question: Your budget proposes $6 million for the direct steel making project with AISI. AISI has requested $7.5 million. What will not be accomplished at this reduced level if your budget request is approved?

Answer: The $6.0 million in the FY 1991 request is consistent with the current cooperative agreement. Under a cooperative agreement, the next increment of work will be negotiated for a 12-month performance period. These negotiations will be concluded in the fourth quarter of FY 1990. AISI is negotiating to receive a higher level of funding than planned in the signed cooperative agreement.

Question: AISI ~~is~~ also seeking $2 million for DOE for a proposal that involves the research and development projects required to move toward intelligent process control covering the total conversion process from ore to final product. Does your budget include any funding for this project and what is your assessment of this proposal?

Answer: The DOE FY 1991 request does not include funding for a new AISI project on intelligent process control. To date, no proposal has been submitted to DOE by AISI on intelligent process control, and it would be inappropriate to budget for a proposal we have not seen or evaluated.

QUESTIONS SUBMITTED BY CONGRESSMAN CHESTER G. ATKINS

- Electrochromic Windows

Question: Is DOE planning to continue and/or expand this [electrochromic windows] research?

Answer: DOE is planning to continue this research. The requested level of effort, direction and mix of contractors will be determined by a review of this research to be conducted before the start of the next fiscal year.

Question: Please provide a detailed outline for the Committee of the Department's research and development agenda, including expected funding levels, for electrochromic windows for fiscal years 1990 through 1992.

Answer: The electrochromic windows R&D for FY 1990 is at the $1,000,000 level and the requested level of effort in FY 1991 is $900,000. The current and planned activities are described on p. 278 of DOE's Conservation and Renewable Energy budget request. The FY 1992 request will depend upon a review of this technology and will be contained in the Administration's budget submission for that year.

Question: ...the Electro-Optics Technology Center at Tufts University has not yet received their funding for fiscal year 1990, which is the second year of a four year grant for them. Why is this the case?

Answer: The funding of the Tufts activity was delayed as a result of personnel changes at DOE and a reorganization within the Conservation and Renewable Office. The new program managers required a little time to become familiar with the work. However, funding was provided to Tufts during this period so its work could continue. The funding for the year has been approved at DOE headquarters and the funds have been sent to DOE's San Francisco Operations Office to support the Tufts activity. Because of a reduction in the appropriation for the Solar Buildings activity, the funding for Tufts is being reduced from $220,000 in FY 1989 to $180,000 in FY 1990.

Question: When will they receive their FY 1990 funds?

Answer: Tufts has received authority to incur expenses against its FY 1990 funds so that no interruption in activity has occurred. The grant funds for the remainder of the year will be provided in June.

Question: Is DOE planning any changes in its grants for electrochromic window research in fiscal year 1990 or fiscal year 1991?

Answer: DOE is planning a modest reduction in all of its electrochromic window research activities in 1990, compared with 1989, due to a reduction in its Solar Buildings research program from $5.2 million in 1989 to $4,0 million in 1990. A review of the electrochromics work is planned for later in FY 1990 and, depending on the results of that review, changes may be made in FY 1991 in the level of effort, technologies pursued, and mix of grantees and contractors.

Question: If so [if changes are made], please provide for the Committee documentation supporting any decisions to stop funding for Tufts University and/or EIC Laboratories, Inc.

Answer: If changes are made to stop funding for Tufts University and/or EIC Laboratories, Inc., DOE will provide an explanation of this decision to the Committee.

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